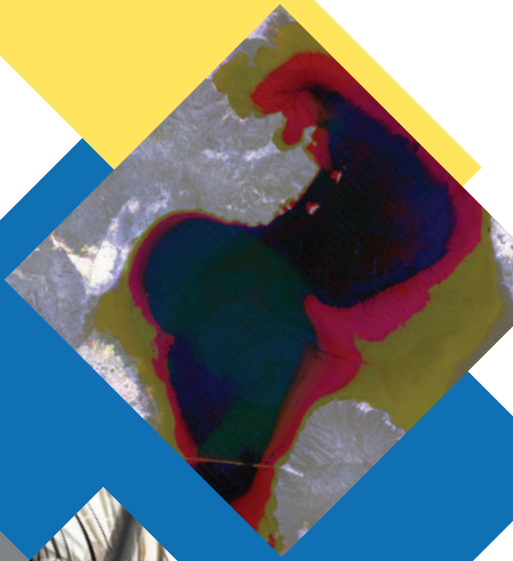
NC STATE UNIVERSITY

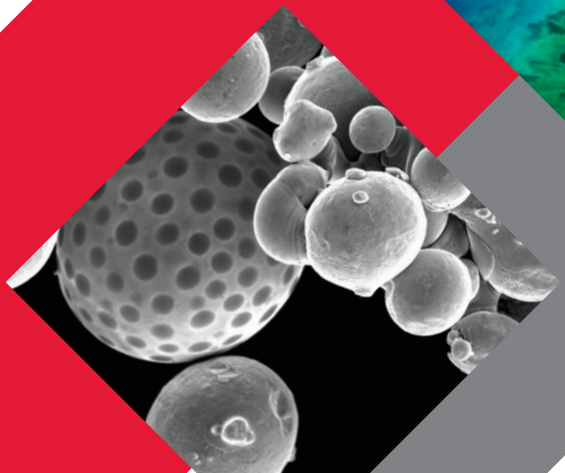
14th Annual
Graduate Student Research Symposium

ABSTRACTS

Wednesday
March 20, 2019
1:00 to 5:30 pm
McKimmon Center








The Fourteenth Annual
North Carolina State University
Graduate Student Research Symposium

SYMPOSIUM ORGANIZERS

Graduate School

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

Graduate Student Association (2018-2019)

Sugandha Singh – Civil and Environmental Engineering (Co-Chair)
Erin Peterson – Genetics (Co-Chair)
Urmila Adhikari – Plant Pathology (Co-Chair)
Anthony Powell – Mathematics
Annabel Meade – Biomathematics
Braxton Hicks – Psychology
Carl Meunier – Chemistry
Erik Myxter-lino – International Studies
Katherine Cupo – Poultry Science
Lynesia Taylor – Operations Research
Megan Boland – Biological and Agricultural Engineering
Tamika McElveen – Teacher Education and Learning Sciences

AGENDA

March 20, 2019

12:00 p.m. - 1:00 p.m. Poster Set Up (All set up their posters) .....Area 1

1:15 p.m. - 1:30 p.m. Welcoming Remarks and Symposium Overview Room 6
Mr. James Withrow, GSA President
Dr. David Shafer, Assistant Dean of the Graduate School

1:30 p.m. - 4:00 p.m. Poster Session and Competition..... Area 1

4:15 p.m. - 5:30 p.m. Announcements of Awards and Reception ..... Room 2
Dr. Peter Harries, Interim Dean of the Graduate School
Dr. David Shafer, Assistant Dean of the Graduate School

TABLE OF CONTENTS

College of Agriculture and Life Sciences

College of Design

College of Education

College of Engineering

College of Humanities and Social Sciences

College of Natural Resources

College of Sciences

College of Textiles

College of Veterinary Medicine

Poole College of Management

ABSTRACTS

College of Agriculture and Life Sciences

Mariama O. Ashcroft
Graduate Program: Youth, Family, and Community Sciences
Advisor: Annie Hardison-Moody
Poster Number: 141

Intersection of Religion, Gender, Migration, and Intimate Partner Violence: An Exploration of How Married Men of Gambian Origin Conceptualize Marital Quality

Intimate partner violence (IPV) against women is a global public health, social, and human rights crisis that is pervasive and indiscriminate. Although men also experience IPV victimization, IPV against women is the most pervasive form and mostly perpetrated by men. Much research has been undertaken in many countries to understand the phenomenon, its determinants, and its consequences. However, there is a dearth of research on IPV in many parts of the world including The Gambia. The present study focuses on the socio-cultural factors that shape men's beliefs about gender and IPV against women from the perspective of Gambian married men living in and outside The Gambia. The objective was to explore the individual beliefs, cultural norms, and societal expectations that influence how married men from The Gambia conceptualize marital quality, gendered behavior, and IPV in a heterosexual marriage. In-depth semi-structured interviews were conducted with 11 married men of Gambian origin recruited using purposive sampling technique. Interviews were conducted face-to-face with six participants residing in The Gambia and by phone with five participants who were US residents for 3 to 21 years. From the perspectives of these research participants, marital quality and IPV are largely shaped by religious beliefs, social norms, and their migration status. These participants believed that social norms in The Gambia sustain gender inequality and IPV and that Gambians tend to use religion to justify women's subordination and IPV. Gambian immigrants to Western countries were more likely to espouse gender equality and less likely to justify IPV. This research highlights the complex interplay of religious beliefs and socio-cultural norms that shape how men perceive gender expectations in marriage and IPV against women.

Jared A. Balik[1,2,3], Brad W. Taylor[1,2], Susan E. Washko[2,3,4], and Scott A. Wissinger[2,3]
Graduate Programs: Applied Ecology[1]; Departments of Biology and Environmental Science, Allegheny College[2]; Rocky Mountain Biological Laboratory[3]; Department of Watershed Sciences, Utah State University[4]
Advisor: Brad W. Taylor
Poster Number: 13

High Interspecific Variation in Nutrient Excretion Within a Guild of Closely-related Caddisfly Species

Understanding the amount of variation in functional traits between closely related species within guilds is critical for understanding links between community composition and ecosystem processes. Nutrient excretion is an important link between animals and their environments, and aquatic invertebrate communities can supply a considerable proportion of ecosystem nutrient demand via excretion. We quantified nitrogen (N) and phosphorus (P) excretion rates of 10 species of larval caddisflies that inhabit high-elevation ponds and wetlands to determine the magnitude of variation in nutrient excretion within this guild. We found considerable interspecific variation in biomass-specific excretion of nitrogen (eightfold differences), phosphorus (sevenfold differences), and the stoichiometric N:P ratios (fivefold differences). Through a meta-analysis, we compared the variation within this guild to the variation found in other family-level species assemblages to determine the overall range in the variation of nutrient excretion that could be expected across guilds and to determine whether the variation in this caddisfly guild is comparatively extreme, average, or low. The meta-analysis revealed a large range in variation among guilds, and comparatively, the variation within this caddisfly guild is high for N excretion and intermediate for P excretion. The considerable variation within guilds revealed by our meta-analysis suggests that functional redundancy among guild members is difficult to predict. Thus, some natural or human-caused species gains or losses within biological groupings such as guilds and trophic levels could have little or no effect on ecosystem processes, whereas others could have very large effects.

Rachel L. Berube, Emma Cannon, Olivia Watson, and Travis D. Park
Graduate Program: Agricultural and Extension Education
Advisor: Travis D. Park
Poster Number: 18

College and Career Advising by Secondary Agricultural Education Teachers: Preparing High School Students for Success

While many factors influence a student's career choice, significant adults such as high school agriculture teachers have a major impact on their decisions. By understanding how agriculture teachers' roles are embedded within students' contextual influences defined by the Social Cognitive Career Theory, this study aims to better identify how teachers' collegiate and career advice can operate as either opportunity structures or barriers to their students. A simple random survey was conducted of all North Carolina high school agriculture teachers. The purpose was to describe how secondary agriculture teachers advise their agricultural education students to prepare for college admission and careers in agriculture. Responses from the study are still being collected, but in a pilot study conducted in New York agricultural science teachers reported creating opportunities for students to explore careers. Teachers did not appear to help students develop concrete post-graduation plans. Teachers did not indicate instructing students to develop a career plan in agriculture courses or a four-year plan of high school courses to prepare students for college or their preferred career. This information can be used by teachers to determine ways to improve curriculum, develop concrete plans for their students to become career or college ready, and bridge the gap of communication while creating a better understanding of the college admissions process. Findings can also be used by university recruiters and faculty to understand how best to work with agriculture teachers to connect high schools to colleges of agriculture and careers in agriculture.

Trisha Bhatia, K.P. Sandeep, and Josip Simunovic
Graduate Program: Food Sciences
Advisors: K.P. Sandeep and Josip Simunovic
Poster Number: 20

New Technology Alternatives for Optimization of Microwave Assisted Extraction (MAE) of Anthocyanins from Purple-Fleshed Sweet Potatoes (PFSP)

Purple anthocyanins, found in fruits and vegetables, have proven antioxidant functionality, anti-inflammatory benefits, anti-cancer potential, and support cardiovascular system. Anthocyanins act as natural colorants at different pH values (from orange red at pH 1 to mustard yellow at pH 13). The goal of this research was to develop a solvent-free MAE for purple anthocyanins from Stokes variety of PFSP. Continuous flow microwave processing (CFM) was developed for production of high-quality fruit, vegetable and beverage products. Several processing formats have been applied in research and commercial processing. CFM Extraction is the next implementation, incorporating 2450 MHz or 915 MHz equipment, depending on processed materials and production capacities. Several equipment installations were studied. Dielectric properties (915 MHz and 2450 MHz) were measured from 23-110 °C. Dielectric constant decreased with increasing temperature (from 63.69 to 58.24 at 915 MHz and from 57.49 to 52.08 at 2450 MHz), dielectric loss factor increased with increasing temperature (from 19.20 to 45.15 at 915 MHz and from 19.11 to 23.50 at 2450 MHz) and loss tangent increased with increasing temperature (from 0.30 to 0.55 at 915 MHz and from 0.33 to 0.45 at 2450 MHz). PFSP were washed, peeled, cut into 1" cubes, steam blanched at 90 °C for 2-3 minutes prior to microwave-assisted extraction. The optimum material to water ratio (1:1) and time-temperature exposure (100 °C for 9 minutes), determined from preliminary experiments, were used to extract anthocyanins from samples. Folin-Ciocalteu's method and pH-differential method were used to analyze total phenolic content and extracted anthocyanins respectively. Samples were found to contain 290.03 mg per 100 g Chlorogenic Acid Equivalent (CAE) (72.2% extraction) total phenolics and 33.81 g per 100 g (42.15% extraction) of anthocyanins. Results indicate high potential for efficient extraction using novel MAE for production of purple anthocyanin extracts and concentrates from PFSP.

Monique Carvalho de Santana and Colin D. Kay
Graduate Programs: Nutrition and Food Science
Advisor: Colin D. Kay
Poster Number: 28

Establishing Optimal Nutritional Quality of Blueberries Using Common Plant Breeding and Processing Practices

Americans consume less than 13% of the recommended daily intake of fruits and vegetables. Recommended food consumption levels are correlated with reduction of chronic degenerative diseases. Consumption of blueberry phytonutrients is shown to provide such health benefits. Aiming to deliver enhanced nutritional value per berry while maintaining consumption patterns, research groups at the Plants for Human Health Institute are applying genomics, phenotyping and *in vitro* bioaccessibility screening of commercial and non-commercial blueberry varieties, to establish nutritionally enhanced varieties. An equivalent portion of blueberry phytonutrients will be complexed with protein to enhance their bioaccessibility and used as an ingredient in a protein bar, to assess if a processed food can also deliver equivalent nutritional value to berries. The present nutritional intervention study aims to compare the 48-hour absorption and clearance of blueberry-derived phytonutrients and metabolites following acute consumption of a commercial blueberry variety, a bred blueberry variety selected for their enhanced bioaccessibility, a processed food product made from blueberries, and a blueberry control powder with matched nutritive content (excluding phytonutrients), to verify if phenotyping, genomic and *in vitro* bioaccessibility screening can be used to generate crops and processed foods with enhanced nutritional value. We will recruit healthy male and female (n=28) participants between 30 and 60 years old within 20 miles of Kannapolis, NC, to participate in a 4-arm randomized crossover study. Urine and blood will be collected from the participants after consumption of each intervention for phytonutrient and metabolite analysis via ultrahigh performance liquid chromatography-tandem mass spectrometry (UPLC-MS/MS). It is expected that the selected bred blueberry variety or processed protein bar will provide higher phytonutrient bioavailability than the commonly consumed commercial blueberry variety. This pilot work could lead to redefinition of serving sizes relative to nutritional quality of fruits, vegetables and processed foods high in fruit and vegetable matter.

Megan Codallo
Graduate Program: Agriculture and Extension Education
Advisor: Jackie Bruce
Poster Number: 36

Factors That Influence Retention and Dropout in Colleges of Agriculture

Recruiting students into higher education institutions and specifically Colleges of Agriculture does not directly translate to an increase in degrees granted. There is insufficient work done on the retention of students in colleges of agriculture. In order to sustain the agricultural workforce we must not only invest in recruiting students to Colleges of Agriculture we must also understand why students are leaving Colleges of Agriculture prior to completing their degrees to aid in facilitating their completion process. Using Tinto's Model of Institutional Departure, this study explores the factors that contribute to a student's decision to drop out of a four year, higher education agricultural degree program and how they make meaning of their experiences. Guiding this research are the following questions: 1) How did experiences within the individual's formal and informal academic and social systems lead to dropout and 2) How did interactions from external communities contribute to the student's decision to drop out? For this phenomenological study the researcher is collecting data through in person, semi-structured interviews. The implications of this research are understanding why students chose to withdraw from colleges of agriculture and what these colleges can do, if anything, to provide more support to students to facilitate completion of degrees.

Daniel P. Collins and Jackie Bruce
Graduate Program: Agricultural and Extension Education
Advisor: Jackie Bruce
Poster Number: 38

Queering the College of Agriculture and Life Sciences

Students who identify as lesbian, gay, bisexual or transgendered (LGBT) have reported that they have experienced some form of marginalization on their campuses because of their sexual orientation. By bringing forth the positive and negative experiences, the focus stems on challenges that are faced by marginalized college students in their campus communities. Research has shown that the lack of a climate of inclusivity inhibits LGBT and heterosexual groups on college campuses. Interviews with current and former students took place to ascertain feelings and thoughts about their experiences on NC State's campus. The purpose of this study was to understand the student perspectives of the LGBT community in the College of Agriculture and Life Sciences. Themes that emerged from this study were self-identity, faculty interactions, perceptions, resolutions, peer interactions, faculty interactions and future opportunities.

Jigar Desai
Graduate Program: Biochemistry
Advisor: Colleen Doherty
Poster Number: 187

Warm Night-time Temperature Results in Global Disruption of Transcriptional Rhythms in Field-grown Rice

The ability to predict the onset of day/night provides a significant fitness advantage. Plants use both daily changes in light and temperature to help them predict the time of day. Here we investigate how changes in temperature affect temporally regulated processes and timekeeping mechanisms. As previously reported in rice, yield decreases under WNT (warm night temperatures). In contrast to increased daytime temperatures, a 1°C increase in temperature at night results in up to 10% yield loss in rice. Molecularly, we observe disruption for many transcripts, the most prominent difference coming from genes that have a cyclic pattern of expression. Importantly, the time of day the plants are sampled is important for identifying transcript and metabolite differences. By examining transcriptional regulators, we identified a strong link between temperature disruption of transcription and a handful of circadian clock genes. The large, global effects on transcription we observe suggest that, on exposure to WNT, the tight coordination between internal molecular events and the environment is disrupted in the flowering panicle. These system-wide perturbations of timing in responses to WNT may affect coordination of the molecular timing of activities and the identification of affected transcripts and metabolites identifies potential molecular mechanisms driving sensitivity to nighttime temperatures and candidates to improve tolerance.

Nicholas Faulkner
Graduate Program: Microbiology
Advisors: Michael R. Hyman and Eric S. Miller
Poster Number: 52

Catalytic and Structural Characterization of an Epoxide Hydrolase (EphA) from the Isobutene-Metabolizing Bacterium Mycobacterium sp. ELW1

Background: In biological systems, gaseous alkenes such as ethene, propene, n-butene, 2-butene, isoprene and isobutylene are typically oxidized to epoxides by monooxygenases. Without rapid detoxification, these highly reactive metabolites can cause cellular damage by oxidizing membrane lipids and alkylating proteins and nucleic acids. Gaseous alkene-metabolizing bacteria have diverse epoxide-degrading mechanisms. Mycobacterium sp. ELW1 grows on isobutylene and is one of the few bacteria in which epoxide hydrolysis is involved in alkene metabolism. The enzyme responsible for epoxide hydrolysis in strain ELW1 is an epoxide hydrolase (EphA). In this study we have heterologously-expressed EphA and have explored the structural and catalytic features of this enzyme. Methods: The ephA gene was cloned into a plasmid for overexpression in E. coli. Once expressed, His-tagged EphA was purified by FPLC nickel affinity and size exclusion columns. His-tagged EphA was crystalized for structural analysis and the activity, substrate range, and enantioselectivity were determined using gas chromatography. Results: Heterologously-expressed EphA stoichiometrically hydrolyzed 2-methyl-1,2- epoxypropane (isobutylene oxide) to 2-methyl-1,2-propanediol with an estimated Vmax of 29 ± 4.5 mmol min-1 mg -1. EphA also hydrolyzes other simple epoxides including epichlorohydrin, short chain terminal epoxyalkanes, and cycloaliphatic epoxides. EphA also slowly hydrolyzes both cis and trans 2,3-epoxybutane and is highly enantioselective towards the S-enantiomer of trans 2,3- epoxybutane. When crystallized, EphA is in space group P2221 with a resolution of 2.59A°, demonstrating an alpha-beta fold hydrolase commonly associated with epoxide hydrolases. Conclusions: This is the first microbial epoxide hydrolase to be structurally and enzymatically studied associated with an isobutylene catabolic pathway. Properties of EphA account for the previously studied physiology of ELW1 and demonstrate that enzymes of isobutene catabolism can be studied *in vitro*.

Meredith Favre
Graduate Programs: Entomology and Plant Pathology
Advisor: Marcé D. Lorenzen
Poster Number: 53

Using CRISPR to Cut Goliath Down to Size? Exploring Genetic Control of Insect Body Size using *Tribolium castaneum* Goliath Mutants

As the human population grows, so will the strain on our food production systems. More sustainable protein sources, alternatives to conventional livestock, are desperately needed. The yellow mealworm, *Tenebrio molitor*, is a promising candidate since it has a smaller ecological footprint, but its nutritional profile is comparable to that of chicken, beef, and pork. Moreover, *T. molitor* is consumed globally, yet remains a relatively unexplored food option in the Western world. We are investigating a mutation that will increase our understanding of genes influencing body size in a closely related species, *Tribolium castaneum*, the red flour beetle. Understanding this mutation could potentially enable us to produce larger mealworms for food and other applications. The Goliath (Go) mutation is dominant and is characterized by larvae that undergo supernumerary molts. As a result, Go mutants attain giant sizes as late-stage larvae, pupae, and adults. We hypothesize that Go impacts one or more genes affecting hormonal regulation of metamorphic development. Our goal is to discover what genetic elements produce the Go phenotype and if this giant-sized trait could transfer to *T. molitor*. One challenge is Go is lethal in homozygous form, making it impossible to establish a pure Go line. Prior work by our collaborators identified the general location of Go within the T. castaneum genome. We are using genes close to Go as targets to perform a CRISPR-Cas9-mediated knock-in of a fluorescent marker gene. This marker will allow us to track and separate Go mutants from wild-type siblings at the same developmental stages and to analyze differences in their gene expression profiles. Using this transcriptomic data, we will identify candidate genes and investigate their association with Go using RNAi-mediated gene silencing. Lastly, we will use CRISPR-Cas9 to attempt recreating the Go phenotype in *T. molitor*.

Kyle Griewisch
Graduate Program: Microbiology
Advisors: Joshua Pierce and Johanna Elfenbein
Poster Number: 64

Synthetic 4-Oxazolidiones: The Search for Antimicrobial and Antibiofilm Drug Targets

Many bacteria, including *Salmonella* Typhimurium, are intrinsically resistant to antimicrobials by developing robust biofilms. As a result, these bacteria are encased in a rigid extracellular matrix composed of proteins and exopolysaccharides. Recently we have developed a potent class of synthetic 4-oxazolidinone analogs derived from the Lipoxazolidinone A marine natural product. We hypothesize that these new synthetic analogs will provide a new class of anti-biofilm compounds. We tested the effect of one 4-oxazolidinone analog on planktonic growth and biofilm formation as assessed by crystal violet assay. We found that the compound inhibits *Salmonella* biofilms in a dose dependent manner without causing a significant reduction in planktonic growth. Next, we screened two defined *Salmonella* Typhimurium mutant libraries (Porwollik 2014) to study the mechanism of biofilm inhibition. In our two-step screening approach, we began with mutants in large genomic regions (multi-gene deletion, MGD) and then evaluating mutants in single genes associated from the genomic regions of interest. We screened 151 MGD mutants, finding 14 mutants with altered biofilm in the presence of our analog as compared with the WT organism. From these mutants, we generated a list of 98 single-gene deletion mutants to establish which gene(s) were responsible for the observed phenotype. We found that 6 single gene deletion mutants produced an altered biofilm as associated with the compound. Of the mutants exhibiting altered phenotypes, we identified genes coding for a component of the major AcrAB-TolC drug efflux pump, 2-aminoethylphosphonate transport, the 50s L36 ribosomal protein, and putative cytoplasmic and periplasmic proteins (n=3). The results of our study provide information as to the cellular targets of the anti-biofilm synthetic 4-oxazolidinone. Further evaluation of the role of each of these genes in both sensitivity and resistance to the compound will aid in establishing the mechanism by which the 4-oxazolidinone small molecule alters *Salmonella* biofilm.

Dmitry Grinevich, Jigar S. Desai, Colleen J. Doherty, Jiaqi Duan, Erin Slabaugh, and Kevin P. Stroup
Graduate Program: Molecular and Structural Biochemistry
Advisor: Colleen J. Doherty
Poster Number: 65

Novel Transcriptional Responses to Heat Revealed by Turning Up the Heat at Night

Heat stress has significant adverse effects on plant productivity worldwide. However, most experiments examining heat stress are performed during daytime hours which generates a diurnal bias in the pathways and regulatory mechanisms identified. Such bias may confound downstream interpretations and limit our understanding of the full response to heat stress. Our results show that the transcriptional and physiological responses to a sudden heat shock in Arabidopsis are profoundly sensitive to the time of day. We observe that the ability of a plant to tolerate and acclimate to heat shock varies throughout the day and is maximal at dusk. We performed RNA-Seq analysis to determine the global transcriptomic changes caused by heat shock in Arabidopsis across two times of day. We employed computational analyses including differential expression analysis, gene ontology enrichment analysis, and cis-regulatory motif enrichment techniques to characterize global transcriptional changes. Consistently, over 75% of heat-responsive transcripts show a time of day-dependent response, including many previously identified heat-response genes. This temporal sensitivity implies a complex interaction between time and temperature where daily variations in basal transcription influence thermotolerance. When we deconstructed these transcriptional responses, we uncovered novel time-specific response genes and cis-regulatory elements, underpinning new aspects of heat stress responses not previously appreciated. Exploiting this temporal variation can be applied to most environmental responses to understand the underlying network wiring. Therefore, we propose that using time as a perturbagen is an approach that will enhance our understanding of plant regulatory networks and responses to environmental stresses.

Adam Groth and Eric S. Miller
Graduate Program: Microbiology
Advisor: Eric S. Miller
Poster Number: 66

Characterization of *Paenibacillus larvae* Bacteriophage Host Range

Paenibacillus larvae is a gram-positive spore-forming bacterium and the causative agent of American Foulbrood (AFB). AFB is a bacterial disease of the European honey bee (*Apis mellifera)*. Current treatments of AFB are limited, primarily when the honey collected is meant for human consumption. Antibiotic treatments are available for active infections but should not be administered while bees are collecting nectar for honey production. Current recommendations are to stop antibiotic treatments eight weeks before nectar collection begins. The most common treatment for a large-scale infection is to burn the combs, bees, and honey store to prevent the spread to other colonies. The use of bacteriophages as a treatment for AFB infections is being explored. A bacteriophage (phage) is a virus capable of infecting a bacterium. Using bacteriophages as treatments for bacterial infections is receiving renewed interest with the increase in antibiotic-resistant strains of bacteria. Fourteen bacteriophages have been isolated in this study that are capable of infecting *P. larvae.* The isolated bacteriophages were sequenced, and genomes annotated. The sequenced phages were tested against five different *P. larvae* strains. The efficiency of the phages to infect different hosts was measured through Efficiency of Plating (EOP) assays. The EOP of individual phages were compared. The phages were also grouped according to their genome-wide similarity. The ability and efficiency of the phages to infect different hosts do not correlate to genome-wide genetic differences. Phages that have been shown to be closely related have different host ranges and efficiencies.

Laura E. Hamon[1,2], Elsa Youngsteadt[1], Clyde E. Sorenson[2], and Rebecca E. Irwin[1]
Graduate Programs: Biology[1]; Entomology[2]
Advisors: Rebecca Irwin and Clyde Sorenson
Poster Number: 69

Pollination and Floral Biology of Venus Flytrap

Venus flytrap (*Dionaea muscipula*) is a perennial herb native only to wet coastal plain habitats in southeastern North Carolina and northeastern South Carolina, where it is considered a Species of Special Concern – Vulnerable by the state of North Carolina. Although the mechanism by which Venus flytrap captures and digests prey is an area of active study, very little is known about other key aspects of its biology, including its reproductive biology. This is concerning given its rare status, and the potential importance of maintaining effective pollination as part of a practical conservation management plan. The goal of this study was to uncover basic aspects of Venus flytrap floral biology, including self-compatibility, pollen-ovule ratio, and the timing of reproductive organ presentation. To do this, we hand-pollinated flowers, collected fruits and anthers, and observed a subset of individuals throughout the flowering period. We also collected stigmas after single pollinator visits to determine which insect species are the most effective at depositing pollen, and could therefore be a conservation priority. Preliminary data show that Venus flytrap is self-compatible but still requires a motile vector to produce seed. Flowers remained open for 2-3 days, and pollen was typically depleted before the stigmas became receptive. Bees deposited more pollen to stigmas than flies, but more data are needed to determine the relative effectiveness of different bee and beetle taxa. These results are part of an ongoing natural history study of Venus flytrap floral biology, and additional work will examine pollinator effectiveness, nectar composition, floral scent, and the role of prey versus pollination in seed production. This will inform our understanding of the role of pollination to the persistence of remaining Venus flytrap populations, which face continued threats from fire suppression, development, and poaching.

Eli D. Hornstein[1,2], Riddhi Rajyaguru[2], and Heike Sederoff[2]
Graduate Programs: Plant Biology[1]; Plant and Microbial Biology[2]
Advisor: Heike Sederoff
Poster Number: 78

Re-engineering Mycorrhizal Symbiosis into Non-mycorrhizal Plants for Better Yield

Arbuscular mycorrhizae are symbiotic structures in plants that improve uptake of nitrogen and phosphorous, as well as drought and disease resistance. A fungal symbiont provides nutrients to its plant host from the soil. In return, the plant provides fixed carbon to the fungus. Mycorrhizal symbiosis dates back to the common origin of land plants and is essential to the biology of almost all modern plants. However, a small minority of plant species have lost the ability to form any mycorrhizae at all. Relative to their phylogenetic rarity these nonmycorrhizal plants are significantly overrepresented in agriculture, by the important families Brassicaceae (canola, cabbage, broccoli) and Amaranthaceae (sugar beet, spinach, quinoa). Given that mycorrhizae commonly confer yield benefits in the range of 20-100% to their hosts, the potential impact on agriculture of the lack of AM symbiosis in these crops is huge. This study investigates the potential for restoring mycorrhizae to nonmycorrhizal plants, both as a means of increasing yield and of understanding why mycorrhizae were lost in the first place. Our bioinformatic analysis indicates that many genes essential for mycorrhizae are retained in the nonmycorrhizal oilseed *Camelina sativa*, while the gene IPD3 is both strictly necessary and clearly absent from the genome. IPD3 is a member of the Common Symbiosis Pathway which enables fungal signals to be received by the plant and transduced into transcriptional changes of genes directly implicated in cell restructuring and nutrient exchange. We inserted transgenic IPD3 into *Camelina* in native and synthetically activated forms. These transgenic lines will be phenotyped for colonization by a mycorrhizal fungus to determine if IPD3 truly is the key element behind this trait loss. Transcriptome analysis will be used to detect molecular interactions of IPD3 with putatively conserved symbiosis genes regardless of anatomical phenotype. Preliminary results are presented on the poster.

Samuel H. Ingram[1], Matt H. Poore[1], and Alan Franzluebbers[2]
Graduate Programs: Animal Science[1]; ARS-USDA, Soil Science[2]
Advisor: Matt H. Poore
Poster Number: 82

Renovation Strategies for Toxic Endophyte-infected Tall Fescue for Profitability, Animal and Agronomic Performance, and Soil Health

Renovating toxic-infected tall fescue (TF) pastures to non-toxic infected tall fescue (NE) for profitability, animal and agronomic performance without compromising soil health is needed to transition to NE in the southeast U.S. Three renovation strategies were evaluated for impact on soil health, profitability, and animal and agronomic performance in a replicated field trial located in Bahama, NC. Strategies included: 1) control (C), 2) renovation to NE after one season of a single specie cover crop (1-SM), 3) renovation to NE after three seasons of a single specie cover crop (3-SM), and 4) renovation to NE after three seasons of a multi-specie cover crop (3-CM). Soil samples were taken prior to renovation to establish baseline soil health measurements for each strategy. Data were analyzed using proc GLM of SAS v9.4. Thirty-two Angus and Angus cross steers (initial BW 425 ± 27) were blocked by BW and randomly assigned to one of four treatments during the first season of renovation. Average daily gain for cattle grazing the first season of cover crops was greatest (P P P < 0.001), with 3-SM being the highest (4511 kg/ha) in comparison to 3-CM (3275 kg/ha), 1-SM (2922 kg/ha), and C (2644 kg/ha), while yield was highest (P < 0.001) for 3-CM in September (2931 kg/ha) in comparison to all other treatments. Data suggests agronomic and animal performance for 3-CM and 3-SM were improved compared to C and could partially alleviate initial renovation costs.

Jing Jin
Graduate Program: Plant Pathology
Advisor: David Shew
Poster Number: 87

Characterizing the Adaptation of *Phytophthora nicotianae* to Partial Resistance in Tobacco

Phytophthora nicotianae causes tobacco black shank worldwide. The ability of *P. nicotianae* to rapidly overcome single-gene resistance was documented following the widespread deployment of the Php gene in tobacco cultivars in the 1990s. Increased levels of aggressiveness in *P. nicotianae* have been documented following exposure to tobacco varieties with high levels of partial resistance. In a previous study, isolates of *P. nicotianae* were adapted on multiple sources and levels of partial resistance by inoculating and reisolating isolates from a given resistance type and level for six consecutive host generations. A single isolate was obtained from each host after each generation of adaptation and these six isolates were characterized for their level of aggressiveness. Our objective in this study was to characterize the adaptation to partial resistance using phenotypic and molecular approaches. We used *in vivo* inoculum production and rate of lesion expansion to quantify the adaptation by *P. nicotianae* and found adapted isolates not only have higher infection rates and produce more sporangia, but also cause larger lesions on tobacco stems. The adapted isolates also were subjected to double digest restriction site associated DNA sequencing to identify genetic changes during adaptation. Understanding how *P. nicotianae* adapts to partial resistance in tobacco will inform better resistance deployment strategies and may increase the durability of partial resistance.

Rika Judd[1], Michael C. Bagley[2], Yue Zhu[1], Mingzhou Li[1], Gaobin Pu[1], Xiting Zhao[1], Caiyen Li[1], Mans Ekelof[2], David C. Muddiman[2], and Deyu Xie[1]
Graduate Programs: Plant and Microbial Biology[1]; Chemistry[2]
Advisor: Deyu Xie
Poster Number: 89

Artemisinin Biosynthesis in Non-Glandular Trichome Cells of *Artemisia annua*

Artemisinin-based combination therapy (ACT) forms the first line of malaria treatment. However, the yield fluctuation of artemisinin has been an unsolved problem for the global ACT demand. This problem is mainly caused by the sole glandular trichome (GT) specificity of artemisinin biosynthesis in all current *Artemisia annua* crops. Herein, we report new discoveries that non-GT cells in a novel self-pollinated (SP) A. annua cultivar and a natural GT-free mutant express the artemisinin biosynthetic pathway. Transcriptional analysis using qRT-PCR demonstrates the transcripts of genes of the artemisinin biosynthetic pathway in leaves of the mutant, and nearly GT-free leaves and calli of the SP inbred cultivar. LC-qTOF-MS/MS analysis show that the three types of GT-free tissue samples produce artemisinin, artemisinic acid, and arteannuin B. Moreover, detailed IR-MALDESI imaging profiling demonstrate that these three metabolites and dihydroartemisinin are localized in non-GT cells of leaves. In conclusion, non-GT cells of the two types of genotypic *A. annua* biosynthesize artemisinin and its derivatives. This fundamental discovery not only adds new knowledge to revise the current dogma of the artemisinin biosynthesis, but also expedites innovation of novel metabolic engineering technologies for high and stable production of artemisinin in the future.

Kayla R. Kinsey
Graduate Program: Biochemistry
Advisor: Jose Ascencio-Ibanez
Poster Number: 99

Mapping *Geminivirus* Immunity in *Arabidopsis* Ecotype Pla-1

Geminiviridae is a family of single-stranded DNA viruses that infect diverse plant species and cause devastating diseases in crops including tomato, cassava, and maize. Current methods of virus prevention have proven insufficient, due in part to the rapid evolution of geminiviruses. The *Arabidopsis thaliana* ecotype Pla-1 has recently been identified as immune to multiple genera of Geminiviruses, including Cabbage Leaf Curl and Beet Curly Top viruses. A locus contributing to this immunity, designated gip-1, has been mapped to an approximately 4-Mbp region on chromosome 1. This was accomplished by Quantitative Trait Locus (QTL) analysis on the F_2 generation of a cross between immune and susceptible *Arabidopsis* ecotypes (Pla-1 and Col-0, respectively). The present research is using a differential PCR technology, Kompetitive Allele Specific PCR (KASP), to prescreen Pla-1 X Col-0 F_2 plants for recombination in the 4-Mbp region of interest. Individuals harboring recombination were then analyzed for QTLs, fine-mapping the gip1 region to about 0.2 Mbp with about 28 genes to be analyzed individually for their contribution to immunity. This region in Pla-1 apparently contains multiple large deletions in the sequence alignment to Col-0. These are also being investigated with PCR and sequencing to determine if there is a true deletion or major change in sequence. Additionally, other loci contributing to resistance have been found, and further QTL analyses will also be performed in order to concretely identify these. Upon identifying the resistance gene(s), its function will be characterized for the elucidation of the Pla-1 immunity mechanism. This should provide a useful weapon for the prevention of geminivirus-causing diseases in crops. The ultimate goal of this project is to use this genetic tool for geminivirus resistance in the modification of important crops, such as cassava and tomato, which will contribute to food security around the world.

Eric Land
Graduate Program: Plant Biology
Advisor: Imara Perera
Poster Number: 105

Inositol Pyrophosphates and the Regulation of Phosphate Homeostasis in Plants

Phosphate (Pi) is a critical macronutrient required for normal plant growth and development. Pi availability is a major limit to crop productivity, and modern agriculture relies heavily on the use of phosphate fertilizers. However, global rock phosphate supplies are finite and over-application of fertilizers cause significant ecological damage to fresh and marine waterways. Plants have evolved several strategies to grow in phosphate limited soils including the activation of phosphate starvation responsive (PSR) genes which results in increased Pi uptake from soil, and altered Pi scavenging and recycling from existing stores. The control of these adaptations however is not fully understood. Inositol phosphates (InsPs) are synthesized by the sequential phosphorylation of a six carbon myo-inositol precursor. The fully phosphorylated form, inositol hexakisphosphate (InsP6) serves as a major store of phosphate. InsP6 can be further phosphorylated by VIP kinases to form inositol pyrophosphates (PPx-InsPs) which are emerging as a novel class of signaling molecules in eukaryotic responses to phosphate starvation. Arabidopsis contains two highly conserved VIP enzymes AtVIP1 and AtVIP2. We generated double null Atvip1/Atvip2 mutants and characterized their response to low phosphate. The vip mutants exhibit altered local and systemic responses to phosphate starvation compared to wild type plants. Additionally, a subset of PSR genes are basally downregulated in the vip mutants, including several involved in lipid remodeling. Our results suggest that PPx-InsPs play a role in Pi sensing and homeostasis.

Hannah Levenson[1,2] and David Tarpy[1]
Graduate Programs: Entomology[1]; Biology[2]
Advisor: David Tarpy
Poster Number: 111

Temporal and Spatial Dynamics of Pollinator Communities Across NC Agroecosystems

Bee populations worldwide are experiencing declines. At issue are the compounded effects of many factors, some of which include habitat loss, pesticide use, and the spread of numerous pathogens. This is especially troubling since bees pollinate billions of dollars of crops annually and 90% of natural areas. Despite their economic and ecological importance, there have been very few native bees whose populations have been thoroughly documented, especially when compared to the wealth of knowledge on honey bees. My study fills the research gap on native bee populations by focusing on an initiative–"Protecting NC Pollinators"–implemented by the North Carolina Department of Agriculture (NCDA) to preserve pollinator biodiversity. This initiative mandates the planting of wildflower seed mixes, creating 'pollinator plots' at all NCDA Experimental Agricultural Research Stations across the state. For the past 3 years I have documented the bee communities at the plots, utilizing bee bowls and sweep netting, in order to monitor the changes in bee populations as a result of the planted habitat. This study will be the most detailed survey of native bee populations across North Carolina to date, and the first to empirically measure the consequences of planting pollinator habitats on native bee communities at the genetic, disease, and community levels. Thus far, the pollinator plots have improved both abundance and diversity of native bee taxa, however the degree to which depends on the site location and quality of the plot habitat. Additionally, we detected less pathogens than expected, suggesting that the plots support pollinator health across many species. As land continues to be developed and natural areas replaced, bee populations will continue to lose habitat and food resources, further contributing to population declines. While many question still need to be answered, my results suggest that pollinator plots are effective at conserving pollinator health, abundance, and diversity.

Donna Liebelt[1], Grant Scarboro[2], Mike Kudenov[2], and Colleen Doherty[1]
Graduate Programs: Biochemistry[1]; Physical Electronics, Photonics, and Magnetics[2]
Advisor: Colleen Doherty
Poster Number: 114

Design of a Modular Field-compatible Abiotic Stress Biosensor

Intra-field spatial yield variability is debilitating not only agronomically but also environmentally. The drive for productivity has led to inefficient use and overuse of fertilizer, pesticides, and water; leading to groundwater and air pollution as well as contributing to the mounting scarcity of fresh water. We propose utilizing endogenous stress-inducible pathways to regulate a field-compatible pigment reporter as a method for early stress detection. For proof of principle, we are developing a biosensor using fluorescent protein detectable in natural light both overexpressed and under the control of promoters from well-characterized stress pathways. Promising promoter candidates have emerged as early drought responsive from preliminary tests. We aim to characterize the promoter's response to drought and other abiotic stresses using luciferase as a reporter in both *Arabidopsis thaliana* and monocot C_4 plant *Setaria viridis* as an agriculturally relevant plant model. Together, our promoter candidates and a field-compatible reporter are a model for an agriculturally-optimized biosensor. The interdisciplinary approach of optimizing the reporter system in both its biochemistry and optical detection will provide a template for the future of biosensors.

Paul C. Bartley III
Graduate Program: Horticultural Science
Advisor: Brian E. Jackson
Poster Number: 15

3-Dimensional Characterization of Plant Roots and Their Environment with X-ray Microtomography

X-ray tomography is an imaging technique pioneered by the medical and petroleum industries to spatially characterize materials. Advances in X-ray technology, software, and commercially available instruments have opened the door for its utilization in horticultural substrate research. Tomographic reconstruction of rooting matrix could provide 3-D, *in situ* characterization of substrate particles, pore structure, and root architecture. To evaluate tomography as a non-destructive and spatial quantification tool, common substrate components and rooted geraniums cuttings were scanned at a resolution of 35 microns. For each substrate component, three-dimensional surfaces were successfully rendered for both the solid and pore phases. Given sufficient contrast between plant roots and organic substrates, geranium roots were successfully segmented from their rooting environment. Given the ability to isolate these three phases, substrates, pores, and plant roots, X-ray microtomography may prove to be a valuable tool in the quantification of dynamic relationships between plants and their rooting environment in container production.

Stella E. C. Nhanala, Chris Heim, and G. Craig Yencho
Graduate Program: Horticultural Science
Advisor: G. Craig Yencho
Poster Number: 137

Screening *Ipomoea* spp. for Improved Drought Tolerance in Cultivated Sweetpotato (*Ipomoea batatas* (L.) Lam)

Sweetpotato (*Ipomoea batatas* (L.) Lam) is a crop cultivated worldwide and is a staple food in many developing countries. In some regions (e.g., Africa) drought is a major constraint on the production of sweetpotatoes, causing roughly 25% yield loss. Climate change is predicted to result in greater losses due to abiotic stresses such as increased temperatures and prolonged dry periods. Close relatives of sweetpotato, adapted to drought-prone areas, may be a potential source of improved drought tolerance in sweetpotato. The goal of this study was to identify wild *Ipomoea* spp. thatare more tolerant to drought when compared to sweetpotato, and therefore, these wild species can be used as a source of genes to improve drought tolerance. We screened *Ipomoea batatas* (Beauregard), *I. batatas* (Tanzania), *I. cynanchifolia*, *I. leucantha*, *I. trifida* and *I. triloba* for drought tolerance. These genotypes were evaluated under greenhouse conditions in a randomized complete block design, with three different levels of irrigation: regular irrigation, no irrigation for seven days, and no irrigation for 21 days. To assess if the genotypes were drought tolerant, we evaluated the following parameters: plant recovery capacity, stem diameter, stomatal conductance, plant biomass and water content. We found that all the genotypes were more negatively affected when they were grown under 21 days of stress rather than seven days of stress. The sweetpotatoes partially lost their leaves and were not able to recover their leaves after re-irrigation. However, the wild species completely lost their leaves, and were able to recover most of the leaves after re-irrigation. We concluded that, statistically, the sweetpotatoes perform better than the wild species; yet, the visual observation showed that the wild species performed better than the sweetpotato cultivars. These results show that the wild relatives may be used as a source of genes to improve drought tolerance.

Ethan T. Pierce, Benjamin P. Graham, Michael R. Stiff, Jason A. Osborne, and Candace H. Haigler
Graduate Program: Plant Biology
Advisor: Candace H. Haigler
Poster Number: 151

Cultures of *Gossypium barbadense* Cotton Ovules Offer Insights into the Microtubule-mediated Control of Fiber Cell Expansion

Cotton fibers undergo extensive elongation and secondary wall thickening as they develop into our most important renewable textile material. These single cells elongate at the apex as well as elongating and expanding in diameter behind the apex. These multiple growth modes represent an interesting difference compared to classical tip-growing cells which needs to be explored further. *In vitro* ovule culture enables experimental analysis of the controls of cotton fiber development in commonly grown *Gossypium hirsutum* cotton, but previously there was no equivalent system for *G. barbadense* that produces higher quality cotton fiber. Here, we describe: (a) how to culture the ovules of *G. barbadense* successfully, and (b) the results of an *in vitro* experiment comparing the role of microtubules in controlling cell expansion in different zones near the apex of three types of cotton fiber tips. Adding the common herbicide fluridone, 1-methyl-3-phenyl-5-[3-(trifluoromethyl) phenyl]-4-pyridone, to the medium supported *G. barbadense* ovule culture, with positive impacts on the number of useful ovules and fiber length. The effect is potentially mediated through inhibited synthesis of abscisic acid, which antagonized the positive effects of fluridone. Fiber development was perturbed by adding colchicine, a microtubule antagonist, to ovules of *G. barbadense* and *G. hirsutum* cultured two days after flowering. The results supported the zonal control of cell expansion in one type of *G. hirsutum* fiber tip and highlighted differences in the role of microtubules in modulating cell expansion between three types of cotton fiber tips.

Steven M. Reyna
Graduate Program: Entomology
Advisor: Marcé Lorenzen
Poster Number: 156

The Development of an RNAi Control Strategy for the Small Hive Beetle

The small hive beetle (SHB), *Aethina tumida* (Murray), is a major pest of managed honey bee colonies in North America and is an emerging threat in South America and Europe. While strong colonies can tolerate low-levels of SHB, weak or stressed colonies can succumb to infestations. Since traditional pesticide-based SHB control practices have a negative impact on bee health, we propose to develop and test a species-specific control method, one expected to have no negative impact on honey bees. RNA interference (RNAi) is a promising alternative to pesticides. It is a sequence-specific gene-silencing mechanism that is initiated by the introduction of double-stranded RNA (dsRNA) into a cell. The RNAi pathway is conserved in insects and has the potential to be used as an insect control technology. To have an effective RNAi control system, dsRNAs must target vital genes and must ingested by the insect. In previous studies, the essential gene, Vacuolar-type H+-ATPase (V-ATPase) was found to cause mortality when dsRNAs targeting this gene were ingested by prominent agricultural beetles such as the western corn rootworm (*Diabrotica virgifera virgifera*), the Colorado potato beetle (*Leptinotarsa decemlineata*), and the sweet potato weevil (*Cylas formicarius*). Here we report results from both injection- and ingestion-based RNAi methods in SHB. Microinjections of dsRNA directly into the hemocoel of SHB will serve as a control for evaluating target genes because ingested dsRNA may not induce RNAi in all insects. The result from this study are expected to provide insights into the biology of SHB and may help establish new insect control method for this pest.

Anna R. Rogers
Graduate Program: Genetics
Advisor: James B. Holland
Poster Number: 160

From Genomes to Fields: Understanding Genotype-by-environment Interactions in Maize Hybrids

Plant breeding programs are often faced with challenges in making initial selections among breeding materials based on evaluation in a single environment, with the ultimate goal of creating new varieties that will later be planted across multiple, more diverse conditions. In some cases, genotypes that initially seemed very promising are observed to vary dramatically for important agronomic traits across diverse environments. Genotype-by-environment interactions (GxE) underlie relative differences in performance across environments but are difficult to predict without understanding how genotypes respond to specific environmental covariates. Recent advances in genomics and prediction modeling have accelerated the ability to perform selections using genomic data, but little has been done to incorporate environmental data into such modeling. Including environmental variables in GxE analysis often results in issues with multicollinearity, caused by presence of large numbers of predictors that are often highly correlated, each of which only explains a small amount of variance. Development of methods to incorporate both genomic and environmental data into genomic prediction models should provide ability to predict genotypic performance in specific new environments. Using publicly available data for 1,919 maize hybrids spread across multiple locations over three years in North America, we explore GxE modeling using a mixed models approach incorporating high density DNA marker data and weather covariates. Using these data, we gain a clearer insight of what GxE means in context of plant development and response to fluctuating environmental conditions, and explore the possibility of predicting hybrid phenotypes in previously untested environments.

Ysenia V. Silva-Guillen[1], Gabriela Martínez[1], Jeffrey Wiegert[1], Consuelo Arellano[2], Raymond D. Boyd[3], and Eric van Heugten[1]
Graduate Programs: Animal Science & Poultry Science[1]; Statistics[2], Hanor Company, Inc., Franklin, KY[3]
Advisor: Eric van Heugten
Poster Number: 195

Impact of Heat Stress and Antioxidant Supplements in Feed or Drinking Water on Growth, Intestinal Morphology, and Oxidative and Immune Status in Growing Pigs

The objective of this study was to evaluate the impact of vitamin E (vitE) or polyphenols supplemented in feed or drinking water as a heat abatement strategy in growing pigs. Individually housed pigs (n=128, 47. 3±5. 0 kg BW) were assigned within weight blocks and sex to a 2x4 factorial arrangement consisting of 2 environments (thermo-neutral (21. 2°C) or heat-stressed (30. 9°C)) and 4 supplementation treatments (control diet (25 IU/kg dl-a-tocopherol acetate); control+100 IU/L vitE (d-a-tocopherol) in water; control+200 IU/kg vitE (dl-a-tocopherol acetate) in feed; or control+400 mg/kg polyphenols in feed). Supplementation was started 7 d prior to temperature treatments applied for 28 d. Heat stress reduced (P=0. 001) final BW, ADG, and ADFI (-7. 4 kg, -26. 7%, and -25. 4%, respectively) and increased (P<0. 001) respiration rate and rectal temperature, but no effects of supplementation were detected. Serum vitamin E concentration increased (P<0. 001) with vitE supplementation (1. 64, 3. 59, 3. 24, and 1. 67 mg/kg for control, vitE in water, vitE in feed, and polyphenols, respectively) and was greater when supplemented in water vs. feed (P=0. 002), especially when measured on d 28 (chronic) vs. d 2 (acute) of heat stress. Liver vitamin E increased (P<0. 001) with vitE supplementation, especially in water, but not polyphenols (3. 9, 31. 8, 18. 0, 4. 9 ppm for control, vitE in water, vitE in feed, and polyphenols, respectively). Serum malondialdehyde (MDA) was greater (P<0. 05) for supplemented pigs compared to control, and heat stress reduced (P=0. 014) serum MDA on d 2, but not d 28. No differences were detected for intestinal morphology or MDA in mucosa of jejunum or ileum. Heat stress decreased (P<0. 03) TNF-a in mucosa of ileum and jejunum, and supplementation reduced (P<0. 05) TNF-a in mucosa of the ileum, but not jejunum. Heat stress markedly reduced performance of growing pigs and supplementing antioxidants in feed or water was not effective in alleviating the impact of heat stress.

Stephen C. Smith
Graduate Program: Horticultural Science
Advisor: Katie Jennings
Poster Number: 178

Evaluation of a High Throughput Optical Grader to Determine Sweetpotato Storage Root Response to Herbicides

High throughput optical graders are being adopted to increase precision measurement of sweetpotato storage roots. The ability to measure shape characteristics of large numbers of roots has the potential to better describe storage root shape in response to environmental and genetic effects. Herbicides are known to effect root and shoot growth at a macro and micro scale. The impact that optical graders can have on describing sweetpotato tolerance to herbicides is unknown. Optical grader measurements of storage roots obtained from herbicide tolerance studies were analyzed to evaluate the potential application of the machine. The optical grader was able to detect herbicidal effects on root shape that were not otherwise distinguishable.

Madison Stahr and Lina Quesada
Graduate Program: Plant Pathology
Advisor: Lina Quesada
Poster Number: 182

Characterizing Factors that Impact Water Dispersal of *Ceratocystis fimbriata*, Causal Agent of Black Rot

Black rot of sweetpotato, caused by the fungal pathogen *Ceratocystis fimbriata*, is considered one of the most devastating diseases of sweetpotato. After the pathogen reemerged in 2014 growers have experienced severe losses, but until basic research is conducted to provide more information about the *C. fimbriata*/sweetpotato pathosystem, effective integrated pest management strategies cannot be achieved. In this study, pathogen dispersal through water was investigated, as sweetpotatoes enter large water tanks prior to packaging for removal of soil and microbes. To better understand *C. fimbriata* dispersal and identify strategies to reduce black rot infections during packaging, the following factors were evaluated: i) inoculum density, ii) inoculum age, and iii) water temperature. For each treatment, 10 sweetpotato roots were surface sterilized with a 10% bleach solution and 5 were wounded with a hand-held tool. For inoculum density, roots were soaked in spore suspensions of 0,5,50,500, and 5000 spores/mL. For inoculum age and water temperature, roots were soaked in 5x103 spore/mL suspensions that were either aged (0,24,48,96, and 144 hours) or adjusted for temperature (10,23,35, and 45°C) respectively. Roots were soaked in the water treatments for 20 minutes, and then stored at 29°C for a 14-day period, with incidence ratings taken every other day. Results showed that disease incidence increased with inoculum density, but low levels of infection were still possible at concentrations of 5 spores/mL. Increased inoculum age negatively impacted disease incidence, particularly in wounded roots, where roots exposed to 144-hour old inoculum showed a minimum 40% incidence reduction when compared to roots exposed to fresh inoculum. Finally, water temperature had no significant impact on disease incidence. These findings indicate that water is a key component for *C. fimbriata* dispersal, and efforts to limit initial inoculum and prevent inoculum build up would be the most effective method of disease prevention.

Marlee A. Trandel[1], Penelope Perkins-Veazie[1], Jonathan Schultheis[1], Chris Gunter[1], and Suzanne Johanningsmeier[2]
Graduate Programs: Horticultural Science[1]; Food, Bioprocessing and Nutrition Science[2]
Advisor: Penelope Perkins-Veazie
Poster Number: 190

Exploring Cell Wall Chemistry to Understand a Watermelon Fruit Disorder

Watermelon, a rich source of cardiovascular-friendly lycopene, represents about $9 million in North Carolina farm gate value. Hollow heart (HH), a defect that causes an internal void in the placental tissue of the fruit, is found predominantly in seedless (triploid) watermelon types, and cannot be visually distinguished from normal fruit unless cut. The incidence of HH can be 0 to 65% of watermelon in a growing season, making it difficult for breeders to develop screening strategies for the disorder. Grafting a watermelon scion to a hybrid squash rootstock increases tissue firmness and decreases HH in susceptible cultivars. Tissue density (the number and size of cells in the heart tissue) dictates tissue firmness in watermelon with quantitatively inherited placental tissue firmness. Using grafted and not grafted watermelon with and without HH, a small cube of fruit placental tissue was extracted from the center (heart) of each fruit, trimmed, and analyzed via confocal microscopy to assess fruit tissue density and its relation to HH incidence. Cells were smaller and more tightly bound in tissue from grafted or non HH fruit, indicating that cell wall strength and tissue firmness may depend on amount of pectin and arrangement of monosaccharide sugars. Cell walls were isolated from watermelon tissue then reduced, hydrolyzed, methylated and acetylated, and analyzed by GC-MS. Cell wall polysaccharide composition and monosaccharide quantification is underway to verify if the cell wall pectin assembly, specifically the composition and structural arrangement of monosaccharide sugars, affects cell wall strength and susceptibility to HH. We hypothesize that grafted watermelons will have more complex pectins than non grafted fruit and HH fruit will have less total pectin content. This knowledge can be used by watermelon breeders to test the potential of genetic markers as screening tools to develop germplasm with monosaccharides associated with stronger cell walls.

Jonathan H. Wall and R.W. Heiniger
Graduate Program: Crop Science
Advisor: Ronnie Heiniger
Poster Number: 193

Using Remote Sensing to Measure Emergence Among Corn Hybrids

Research studies over the past five years have shown conclusively that corn yield is improved when the corn emerges uniformly and grows rapidly from emergence to V6. Studies in 2014, 2015, 2016, and 2017 found that corn plants emerging 24 to 48 hours later than those first observed had fewer rows per ear, kernels per row, and less ear weight resulting in lower yield. Furthermore, these studies found that the only management practices that were consistently effective in improving the uniformity of emergence were hybrids with strong emergence characteristics and the proper planting depth. The goals of this research are to develop new tools for phenotyping multiple hybrids for emergence and rate of early growth and to use those tools in conjunction with the North Carolina Official Variety Testing Program to rate hybrids for emergence and early growth in the southeastern US. Particular objectives are: 1) to develop a method for using spectral data (data taken across multiple spectral wavelengths) to count the number of corn spikes emerging at daily or hourly intervals following planting, 2) to develop methods for measuring canopy development (height and volume), and 3) to use these techniques to measure emergence and growth characteristics of all the corn hybrids entered into the North Carolina Official Variety Testing program and report those characteristics to corn growers for their consideration in selection of hybrids. Results from the first year of this study indicate that corn emergence can be quantitatively measured using sensors flown on unmanned aerial vehicles and that photographs can be useful in measuring canopy cover and height.

Mengying Wang[1], Alexander W. Eyre[1], Michael Ronald Thon[2], Yeonyee Oh[1], and Ralph A. Dean[1]
Graduate Programs: Entomology and Plant Pathology[1]; Center for Integrated Fungal Research, University of Salamanca, Spanish-Portuguese Institute for Agricultural Research (CIALE)[2]
Advisor: Ralph A. Dean
Poster Number: 174

Identification and Characterization of Microbiome Associated with Rice Seedlings

Microbes can develop close interaction with host plants acting as plant epiphytes as well as endophytes. Rice is one of the most important cereal crops agriculturally and economically while there's a limited number of research about microbiome associated with rice which can be beneficial, neutral or detrimental to rice production. In this study, microbiome associated with rice seedlings were identified and characterized. Rice seeds were sourced from two different research locations in Arkansas, USA of two different rice genotypes (Katy, M202) from two different harvest years (2013, 2014). Bacterial as well as fungal communities were identified for four seedling compartments (root surface, root endophytes, shoot surface, shoot endophytes) through 16S and ITS fragments sequencing methods. More abundance and diversity were detected for microbiome associate with roots rather than shoots and more for epiphytes than endophytes. The seedling compartments were analyzed as the driving factor for microbial community rather than other factors such as rice genotype, location and harvest year. Core bacterial and fungal microbiome shared across samples were identified. Core bacteria genera identified in this study such as *Rhizobium*, *Neorhizobium*, *Pantoea*, S*phingomonas* and *Paenibacillus* were also reported as plant growth promoting bacteria in previous research while core fungi from *Pleosporales*, *Alternaria* and *Occultifur* also have the potential to be used as biocontrol agent.

Matthew F. Warren[1,2] and Kimberly A. Livingston[1,2]
Graduate Programs: Nutrition[1]; Prestage Department of Poultry Science[2]
Advisor: Kimberly A. Livingston
Poster Number: 197

Dietary Vitamin D_3 Super Dosage Effects on Older Laying Hens in Production

Vitamin D is important for regulating calcium (Ca^{2+}) metabolism and impacts skeletal health. Vitamin D deficiencies are common in humans. Laying hens fed a super-dose of vitamin D can produce eggs providing up to 1,000 IU (international unit) of vitamin D to combat deficiency in humans. However, little is known about how super dosage levels of dietary vitamin D impacts laying hens physiologically. We surmise hens consuming diets with 10,000% times greater than requirement levels of dietary vitamin D should have similar egg production and increased blood Ca^{2+} concentration because of vitamin D's influence on Ca^{2+} mobilization. Forty-eight 68-week old Hy-Line W-36 laying hens were individually housed in cages with eight birds per dietary treatment for eleven weeks. Birds were randomly assorted between six levels of dietary vitamin D_3 supplementation and fed ad libitum. Suppementation levels were 250 (recommended dosage for hens), 500, 1,500, 15,000, 30,000, and 60,000 IU D_3/kg of feed. Eggs were collected daily from each bird. On week 0 (start of experiment), 3, 6, and 10, blood was collected from same 24 birds to have their blood chemistry analyzed using i-STATTM handheld blood analyzer. No differences were observed for eggs laid, shell strength, or shell thickness. Dietary vitamin D_3 supplementation caused a difference in shell elasticity ($p = 0.044$) with 30,000 IU D_3 fed birds having highest elasticity. Differences were observed for ionized blood Ca^{2+} of hens ($p = 0.002$) with 500 IU D_3 fed birds having highest blood Ca^{2+}. Our results indicate super dosing vitamin D_3 had no negative implications on egg production. Differences in ionized blood Ca^{2+} between birds fed different diets implies Ca^{2+} mobilization was affected by dietary vitamin D_3 without affecting egg production. Increasing dietary vitamin D for laying hens in production can improve their bone health without reducing their egg production.

Qing Xia[1], Thomas Rufty[2], and Wei Shi[1]
Graduate Programs: Soil Science[1]; Crop Science[2]
Advisor: Wei Shi
Poster Number: 202

Soil Texture-based Microbial Community Richness, Composition and Function

Soil texture is an important metric for consideration of crop-soil system management; however, its effects on the soil microbial community and microbial-driven nutrient cycling remain unknown. This work aimed to determine the relationship between microbial richness, composition, and function and soil texture. Soil bacterial and fungal diversity and composition were analyzed using high throughput sequencing of 16S rRNA gene and ITS region from soils having a wide range of clay (4-53%) and sand (30-83%) contents. Our data showed that texture effects were bacteria- and fungi-specific. The more clay the soil had, the more evenly the bacterial community was distributed. In contrast, the more sand the soil had, the more taxa the fungal community possessed. The percentage of sand was able to positively predict some bacterial and fungal taxa, such as *Acidobacteria*, *Proteobacteria*, *Planctomycetes*, *Chytridiomycota*, and *Zoopagomycota*, but negatively for some others, e.g., *Actinobacteria*, *Chloroflexi*, *Basidiomycota*, and *Mucoromycota*. Some microbial taxa were not affected by sand/clay content, including Arbuscular mycorrhizal fungi *Glomeromycot*a, which was negatively correlated with soil inorganic N. A prediction on microbially-mediated nitrogen cycling using PICRUSt also revealed substantial impacts of soil texture. Genes involved in nitrogen fixation and nitrification were found to be greater in soils of high sand content, suggesting a greater potential of the two processes in coarse-textured soils. This work advances the knowledge of soil texture-based microbial diversity, composition and function. It also emphasizes the importance of pore size distribution in understanding the soil microbial community.

Zhongtian Zhang
Graduate Program: Microbiology
Advisor: Gavin Williams
Poster Number: 211

Harnessing Endogenous Type III CRISPR-Cas System for Genome Editing and Transcriptional Perturbation in *Saccharopolyspora erythraea*

Although CRISPR-Cas9/Cpf1 have been widely employed as genome engineering tools, heterologous CRISPR-Cas9/Cpf1 are often difficult to introduce into bacteria and archaea due to their severe toxicity. Since many prokaryotes harbor native CRISPR-Cas systems, genome engineering can be achieved by harnessing these endogenous immune systems. Here, we report the exploitation of a novel Type III CRISPR-Cas system of *Saccharopolyspora erythraea* for genome engineering and transcriptional pertubation. *In silico* analysis showed unique CRISPR arrays and Cas gene arrangement. Plasmid interference assay confirmed its nucleotide cleavage functionality. By expressing a mini 'repeat-spacer-repeat' sequence that mimics the native array, we successfully re-directed the native CRISPR-Cas machinery to target its own genome, integrating mCherry gene with an editing efficiency of 100%. The editing efficiency is significantly higher compared to Cas9 assisted genome editing. We further evaluated RNA degrading functionality of the CRISPR for the application of transcriptional regulation. When targeting on a reporter gene (KanR) without the presence of an editing template, the target gene was significantly inhibited. The developed system herein has a broader application to other prokaryotes containing endogenous CRISPR-Cas systems. *S. erythraea* could be employed as a versatile platform to be engineered for drug precursor and drug analogue production using the native CRISPR-Cas based genome engineering toolkit.

College of Design

Shadrick Addy
Graduate Program: Graphic Design
Advisor: Derek Ham
Poster Number: 2

History Re-experienced: Implementing Mixed Reality Systems into Historic House Museums

This research investigates how house museums can implement mixed reality experiences to increase the experiential value of a visit. As immersive technology has become ubiquitous in today's society, traditional museums are finding success using augmented reality, a subset of mixed reality, to increase visitors' satisfaction. However, due to the immutable nature of house museums, and its tendency to approach cultural preservation by placing visitors in direct contact with historical artifacts, a practical approach to implementing mixed reality systems in historic house museums is needed. Building on user-centered design methods, a series of mixed reality experiences are developed and tested at the Pope House Museum in Raleigh, NC. The goal of the study is to develop a framework that guides how designers can utilize the affordances of mixed reality systems to create experiences that align with the possible historical narrative present in house museums. Experiences that contributes to improving visitors satisfaction, self-interpretation, and understanding of the homeowner's life and the community within which they lived.

Ellis Anderson
Graduate Program: Graphic Design
Advisor: Denise Gonzales Crisp
Poster Number: 6

Virtual Design Improvisation: Enhancing Computer-based Designing Through Embedded Timing, Adaptive & Associative Procedures

Building on improvisational design pedagogy currently taught at the College of Design at North Carolina State University, this research investigates how a responsive software interface might introduce "just-in-time" messages, creative prompts and exploratory exercises to upper-level design students to enhance computer-mediated workflow during a multi-week, research-based design project. The proposed interface seeks to enrich a student's design process by intervening during moments of creative stagnation and design fixation. Computer-based design tools such as Adobe Illustrator, while enabling efficient production and visual complexity, may stifle a student designer's ability to generate a diversity of ideas and exacerbate the potential for hyperfocusing along one conceptual pathway. An opportunity exists for embedding a responsive system that challenges students during computer-based making. The system borrows creative strategy from musical improvisation, a process of thinking and acting on your feet in response to new and shifting phenomena, often yielding chance results when faced with sudden provocation. Improvisational competence can augment divergent thinking and may be able to compensate for common difficulties in the design process such as fixation and attachment to early concepts. In order to encourage the student's improvisational proficiency, the responsive software would exhibit interactive behaviors based on three key elements of musical improvisation: (1) timing, (2) adaptation, and (3) association. The software's behavior would be tailored to the individual student, their working habits, and stage of development within an upper-level undergraduate Graphic Design course taught at the College of Design at North Carolina State University. Methods for investigation include observational studies and surveys of upper-level Graphic Design students at the College of Design, review of relevant literature in (a) design fixation, (b) musical improvisation, (c) design students, (d) creativity, (e) design process and (f) design software, user personas, design prototyping, and testing through participatory workshops.

Alysa Buchanan
Graduate Program: Graphic Design
Advisor: Denise Gonzales Crisp
Poster Number: 24

Supporting Soldier Mental Health While on Deployment: A System of Designed Interventions

Of the 1.8 million U.S. soldiers deployed to Operation Iraqi Freedom and Operation Enduring Freedom in Afghanistan, an estimated 10-18% are likely to have returned home with Post Traumatic Stress Related Disorder (PTSD). Veterans account for 14-16% of suicides in the U.S., yet are 8% of the population. Professionals advise that PTSD treatment should begin as soon as symptoms are observed, which can occur immediately after the event. Delays in treatment can worsen the individual's symptoms. A decrease in martial satisfaction and an increase in depression, anxiety, anger, and addiction following deployments have been observed. Yet when soldiers are deployed, often for six to twelve months at a time, access to mental health care options are limited and under-utilized. This research explores how a system of designed interventions may address the unique mental health care needs of soldiers on deployment. This project acknowledges the barriers and resistance to care and explores the prevailing stigma surrounding therapeutic and healthy coping skills within the military. Solutions are proposed which leverage the unique comradery of the military community to encourage new practices which support mental health care, emotional intelligence, and emotional processing. The first half of this study involved interviews with soldiers and behavioral health researchers, an analysis of the existing mental health care options, a taxonomy of therapy approaches, and visualizations of the relationships (human and non-human) which are involved within this network. Next, rapid ideation produced an exploration of visual and systemic possibilities. These studies consider the user's environmental factors, anonymity requests, military standing, and long-term objectives. The results of this research show that there is a desire, need, and potential for a variety of new mental health care options for soldiers during deployment.

Elizabeth Clark
Graduate Program: Architecture
Advisor: Kristen Schaffer
Poster Number: 35

Community Resilience by Design: Addressing the Social, Economic, and Environmental Needs of a Flood-Ravaged North Carolina Town by Celebrating its Assets

North Carolina's Edgecombe County, a patchwork of mostly small, insulated towns, currently leads the state in obesity, diabetes, heart disease, and resulting deaths. Princeville, the first town in the country to be settled and incorporated by freed slaves, is no exception. Princeville, though it hosts a vivid community fabric, is a special case as it is suffers periodic flooding from the nearby Tar River, especially after 2016's Hurricane Matthew, which has devastated much of the town's infrastructure beyond repair. Consequential disinvestment in the town's economy has forced residents, businesses, and even schools elsewhere, leaving Princeville fundamentally destitute. The proposed Princeville Community Produce Center was ideated through collaboration between designers and town residents, officials, and social authorities, aiming to become a hub of social, economic, health, educational, and cultural reinvestment. Such a center would primarily exist as a way for residents to grow, learn about, and purchase fresh produce, making healthier food part of the influential culture that underpins the town. This project also addresses the tangible site and next life of the historic Princeville Museum and Welcome Center as it evolves to serve modern needs and environmental conditions of Princeville. By holistically considering the many assets and needs that exist in a particular community, designers are better able to create bespoke, responsive projects that address as many needs as possible while celebrating and supporting assets.

Wenyue Ding
Graduate Program: Industrial Design
Advisors: Carolina Gill and Kelly Umstead
Poster Number: 46

The User Experience of Solo Diners in Casual Dining Restaurants in US Urban Areas

Based on a 2016 report from OpenTable, individual customers, or solo diners, have become a large segment of the market in the restaurant industry. As this segment grows, restaurants are beginning to notice the challenges and opportunities that the new volume of customers present. This study focuses on the problems of individual diners, especially business travelers, in casual dining restaurants and the opportunities that exist for restaurants to respond to those needs. Primary and secondary source research, such as literature reviews and interviews, have been used to identify specific problems and define the project scope. The findings show that solo diners are not comfortable when eating alone in a restaurant. Psychologically, they may feel lonely, experience pressure of other people's judgment, or be hesitant to communicate with staff or patrons of the establishment. Physically, they often worry about the safety of their belongings, the violation of personal space, or the lack of privacy in the environment. Restaurants are becoming aware of these conditions but have not been active in responding. The insights from this study reveal opportunities for design interventions, in aspects of service and space design, that can increase the work efficiency for restaurants, servers, and hosts/hostess while addressing the unique needs of the solo diner customers. The considerate connection between customers and restaurants can improve the solo experience and translate in more efficiency and potential revenue for the restaurant industry.

Ingrid Fullerton
Graduate Program: Architecture
Advisors: Kristen Schaffer and Bryan Bell
Poster Number: 55

How Design Can Influence a New Paradigm of Criminal Justice Reform to Increase Social Equity and Community Resiliency: Helping Those at Risk of Incarceration, Those Currently Incarcerated and Those Re-entering Their Community

Restore Justice Raleigh is an exploration of a new paradigm in criminal justice reform. This project presents alternatives and improvements which will serve the population at risk of becoming incarcerated, currently incarcerated or re-entering into the community after incarceration. The intent of the project is to analyze and critique existing problems with America's mass-incarceration problem and offer a solution at multiple scales from state-wide policy partnership to community-based treatment and prevention programming. A new program at the site of existing Central Prison in Raleigh proposes the deliberate design of a community which helps individuals before, during and after incarceration and hypothesizes the effects of its integration with stakeholders from the local to national level. Methods of research include personal interviews with field experts, case study analysis and feedback from individual surveys of those who have experienced incarceration first hand. Key conclusions include the significance of a program which is not only shaped through public policy and government institutions, but which also implements grass-roots, private sector programs at the local level to generate a more resilient community network.

Joachim Gawryolek
Graduate Program: Industrial Design
Advisors: Bryan Laffitte and Kathleen Rieder
Poster Number: 58

Exploring the Need for a Creative-led Community and New Approaches to Develop an Inclusive Environment for Creative Life in a Public Space.

During a discussion forum on Civic Art at a gallery in Raleigh, a local artist asked "Why aren't there any creative spaces that can be used by anybody, at anytime? Where are the public spaces anybody can create in?". The purpose of this study is to explore how public spaces can be redefined to allow for direct community involvement through creative means. From research done by city officials, there is a need for new creative spaces for the above national average demand of access to art in Raleigh. This is substantiated in research done through literature reviews, public surveys, several community events, and interviews with local artists and program directors of various art institutions. The public expressed the need for meaningful interactions with other members of the community, interest in new experiences such as interactive and engaging activities, and creative programming that involves learning opportunities. Most of all, the public expressed that creative public spaces should be accessible, inclusive for all communities in Raleigh and support the needs of these communities to be expressive in a creative way. The research led to designing interactive forms that define a gathering space in which participants are invited to informal encounters with others. Through new forms of expression, perception of values can be shared in an open environment and lead to a dialogue with people who aren't like each other. The general public can participate in the development of Raleigh's arts, not just by being passive recipients, but by directly engaging with their communities to shape the cultural life of Raleigh. Art is often perceived as an individual act of self expression through creative means, while the design of the space has the potential of bringing communities together and allows the public to collectively engage and interact in an activity.

Sarah Hefner
Graduate Program: Architecture
Advisor: Bryan Bell
Poster Number: 75

Mapping the Built Environment: Tactile Models for the Visually Impaired

For blind and low vision persons, lack of spatial awareness is one of the biggest impediments to independent travel. Orientation and mobility instructors at the Governor Morehead School of the Blind teach visually impaired students how to navigate safely through an environment using their remaining senses. With practice, students memorize routes to familiar destinations across campus. However, the memorization of routes fails to provide students with a holistic understanding of the built environment around them. This study explores how the design of tactile maps for the visually impaired may improve their spatial memory, sense of direction, and experience within the built environment. The intent of this study is to develop a portable tactile map prototype for orientation and mobility instructors to use with students while training on campus. Currently, tactile floor plans are constructed using devices like embossers, swell paper printers, and most recently 3D printers. Although these technologies benefit the visually impaired community, plans created from these sources tend to be over simplified, serving simply as wayfinding tools. A human-centered, participatory design approach was used to test map prototypes. Designed for a range of visual capacity, prototypes tested the tactile legibility of map content with stakeholders through interviews and workshops. Based on stakeholder feedback, a hierarchy of information was established through physical attributes on prototypes for more effective communication. Student used buildings on campus were labeled with symbols that corresponded to their function using a map key featuring braille. Thin, raised linework for sidewalks and wide, recessed linework for roads were employed on maps. Additionally, linework was designed with effective color contrast to acknowledge variation in visual capacity among students. The goal of this study is to assist visually impaired students at the Governor Morehead School of the Blind navigate the built environment with improved spatial clarity and independence.

Jessye L. Holmgren-Sidell
Graduate Program: Graphic Design
Advisor: Helen Armstrong
Poster Number: 76

Picture This: Making Picture Books Accessible for Preschool Children with Visual Impairments

Picture books can facilitate preschool children's literacy comprehension and ability to retain information. Through interactive reading with their parents, children begin to internalize the illustrations they see in stories and apply them to real-life experiences. Although picture books offer an array of potential benefits to young readers, they are not a fully inclusive medium for those with visual impairments. Their positive impact on a child's comprehension is reduced if that child has low vision or total blindness. While accessible interactive picture books are available, they typically use raised illustrations that are not scalable. Children feel the pictures alongside their parents, but cannot take accessible elements from one story and use them to conceptualize another; each book is its own entity with its own set of tactile visuals. There is currently no extensive system that children and their parents can apply to existing picture books to make them both accessible and interactive, the lack of which poses an ideal opportunity for design intervention. Using a combination of frameworks and design methods - including interviews with educators, literacy interventionists, and parents; journey mapping; prototyping; and user testing - this investigation will determine how picture books can be made accessible for preschool children with visual impairments to facilitate literacy comprehension and parent-child interactive story reading.

Stephanie Lee T. Huang
Graduate Program: Art & Design
Advisor: Todd Berreth
Poster Number: 80

Fossil Foundations: Behind the Glass

Over the years, museums have evolved from static archives of artifacts to interactive learning centers. With the advent of digital media and increasingly accessible technology, museums are experimenting with emerging technologies to retain visitors' attention and grow their audience. A new paleontology lab at the NC Museum of Natural Sciences (NCMNS), designed with glass walls, will allow visitors to observe the paleontologists and fossil preparators at work. However, observers will not necessarily have any understanding of what lab preparation tools are being used or how they are used. Fossil Foundations: Behind the Glass is an interactive touchscreen display set beside this laboratory. Through collaboration with the NCMNS exhibitions team and the paleontology lab, this digital display will assist in addressing this interaction and knowledge gap between visitor and lab. By leveraging people's intrinsic motivation and natural curiosity for novel experiences and interactive devices, visitors will be coaxed into a more hands-on understanding of the lab's fossil preparation process by experimenting with virtual preparation tools imitating those used by actual fossil preparators. Using user personas, on-site visits, wireframing, and game programming, this project will be built and evaluated as an auxiliary exhibition at the opening of the new lab space. With particular focus on how a state of flow can be achieved in a museum setting to motivate users, and drawing on precedents such as the San Francisco Exploratorium, this project acts as a study in user experience principles and exhibition design to further promote the importance of free-choice and lifelong learning encouraged by public learning spaces, rather than the formal learning found traditional academic institutions.

Maria D. Juri
Graduate Program: Art & Design
Advisors: Cecilia Mouat Croxatto and Hernan Marchant
Poster Number: 91

Diosas Subversive Quilts: Connecting the Digital Nature of the Feminist Fourth Wave to Traditionally Feminine Craft

The voices of women are continuously suppressed. However, the Me Too Movement, an effort to end sexual violence, has created a unique space for women to speak out. This is the Fourth Wave of Feminism, which aims to elevate the voices of those who are working to build a better future for all people, and in the age of Trump feminist solidarity is hitting record levels. Diosas is an art installation designed to amplify the voices of women. The installation features four North Carolinian women who support their communities through different means: Betsy Greer through the disruption of negative thought; Kathleen McDonald through comedy; Ann May Woodward through creative reuse; and Ashley Roudebush Thomas through accessibility. The installation Diosas uses craft and activism as a subversive tool by combining digital photography (a male-dominated field) with craft (a traditionally feminine media). The featured women were photographed and participated in video interviews. Their words and images were used to design and produce a collection of large-scale quilts. The quilts were then installed in the warehouse windows owned by the Scrap Exchange in the Lakewood Shopping Center in Durham, NC. The filmed interviews were edited to provide context and are accessible via QR Codes that are part of the design of the installed quilts. The purpose of Diosas is to give voice to women who are actively changing our communities for the better, by promoting inclusiveness while showcasing the joy from their own efforts. It creates a platform of amplification by combining the digital nature of today's Feminist Fourth Wave with traditionally feminine craft.

Dawoda M. Kah
Graduate Program: Art & Design
Advisor: Cecilia Mouat Croxatto
Poster Number: 92

Learning and Play: Teaching Through a Virtual Reality Game that Allows Collecting 3D Physical Artifacts

Learning and Play is an Educational Game using Virtual reality (VR) to engage students in learning new content, responding to the challenge of new teaching methods capable to motivate the curiosity through an immersive experience. The objective of the project is to design a platform for an educational game with an immersive experience through space, and what makes unique this project is that students can download artifacts during the virtual experience and send them to a three-dimensional printer. Even the platform can be adapted for multiple contents, this pilot experience teaches history of the Christianization of Scandinavia, in which students interact in a virtual reproduction of the Borgund Stavkirke (medieval wooden church in Norway), allowing travels through its interior and exterior spaces, and learning about the iconography sculpted in the interior space, and the tools used in that historical period. The methods used for the project include: (1) Research in Motivation Strategies for teaching and how Optimal Levels of Arousals can lead people into deep states of "flow;" Situated Learning Theory to support the use of an immersive experience, and Identical Elements Theory. (2) Research in Cognitive Load Theory to inform the amount of knowledge that can be retained in a learning experience; Embodiment Cognition Theory and Phenomenology to inform the interaction between a "lived body" and the environment. (3) Research and exploration of technological instruments for the construction and design of the game, including: Autodesk Maya for a 3D creation, exporting art assets as FBX's (Filmbox file format) and importing them into other creation-based software. Adobe Photoshop for the creation of digital paintings and textures; XNormal that works as a Photoshop plugin, used in game engines; ZBrush digital sculpting and painting that assists in the 3D modeling pipeline; Unity3D to create the virtual experience, a cross-platform game engine, and UniStorm, a plugin that attaches to the Unity3D project folder and simulates real-time lighting and weather. As an important part for the creation of a realistic virtual experience, I travelled to Norway in Summer 2018 and visited the church to recollect in a vivid experience, the perceptions I wanted to reproduce in the VR experience. The next steps include testing with users in base to learning objectives defined prior to design the contents included in the game.

Raunak Mahtani
Graduate Program: Industrial Design
Advisors: Kelly Umstead and Carolina Gill
Poster Number: 117

Efficacious Prototyping for Early Stage Industrial Design: Understanding What Matters in Prototyping to Make Prototyping Matter More

Prototypes are integral tools designers, engineers and other creatives utilize for developing solutions. In the broadest sense, the term 'prototype' may mean different things, and be the means to different ends. Prototypes play a significant role in idea generation in the early stages of design projects, and can act as a catalyst for innovation in a collaborative setting. Successful prototypes are thoughtful about their purpose and context of usage. This makes it important to understand how attributes of the prototype and prototyping process affect the design process. The landscape of design is evolving– increasingly efficient and sophisticated technology is used in the prototyping process. Multiple stakeholders and end-users are involved throughout the design process, which makes collaborative prototyping and co-creation a valuable activity. The objective of this project is to utilize such an understanding to improve the tools and technologies to better support design teams through their process. Secondary source research and semi-structured interviews with designers have been conducted to understand the challenges faced and to investigate the attributes of prototyping such as modality (physical versus digital), fidelity (high versus low), materials and processes used, effort and time spent, and their effect on the process. Throughout a dynamic design process, prototyping can be a part of different phases of a project, can involve different sets of stakeholders, and can need to perform in different ways. A key theme to the findings has been that 'economy' and 'effectiveness' are broad needs from the prototyping process, and that specific needs--what is meant by economy and effectiveness--can vary across different scenarios.

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Graduate Programs: Design[1]; Educational Psychology, University of Kentucky[2]
Advisor: Celen Pasalar
Poster Number: 119

Changing Classrooms Bring New Questions: Environmental Influences, Self-efficacy, and Achievement

College classrooms are transitioning from instructor-focused spaces to technology-filled, dynamic environments designed to encourage active learning through collaboration. Significant changes to physical learning spaces likely affect how students feel, think, and learn (Maxwell & Evans, 2014). However, little research has investigated how the physical space affects motivation and learning. This study investigated how students' beliefs and performance varied in two different physical spaces. Using social cognitive theory as a guiding framework, we investigated whether students' assignment to a technology-enhanced, collaborative classroom (Figure 1a) or a traditional, forward-facing classroom (Figures 1b-c) was associated with changes in students' self-efficacy and learning. Undergraduate students (n = 372) enrolled in an entry-level statistics course were assigned to either a technology-enhanced classroom or traditional lecture hall. A single item assessed perceived importance of the physical space. Statistics self-efficacy was measured with 11 items (Finney & Schraw, 2003), a = .902 and self-efficacy for self-regulation with 7 items (Usher & Pajares, 2008), a = .918. Self-report items were assessed on a 4-point Likert-type scale during the first (T1) and last (T2) week of the semester. Course grades were obtained from instructors. We examined mean differences in students' scores by classroom type (between groups) and over time (within groups) using non-parametric t tests. At each time point, students' perceptions of the importance of the learning environment were similar in the two learning environments. At T1, students' statistics self-efficacy and self-efficacy for self-regulation were similar in each learning environment. However, at T2, students assigned to the technology-enhanced classroom reported significantly lower statistics self-efficacy and self-efficacy for self-regulation than did students assigned to the traditional classroom (see Table 1). These findings held even when T1 variables were controlled. Students in the technology-enhanced classroom also earned significantly lower course grades (M = 80.99, SD = 9.50) than did students in the traditional classrooms (M = 84.08, SD = 9.43), t(361) = 3.11, p = .002, d = 0.33. Regression analysis was used to examine the relationship between students' T2 perceptions and final course grades (see Table 2). The nested data structure was addressed using hierarchical linear modeling, which indicated negligible variability at the classroom level. Regardless of classroom type, statistics self-efficacy was the only significant predictor of students' final course grade. Technology-enhanced classrooms are becoming more commonplace in American universities, but their payoff for student learning and motivation has not been thoroughly investigated (Najmabadi, 2017). All students rated the physical environment as important to their learning. We were surprised to find that statistics self-efficacy and grades were significantly higher among learners in the traditional classroom environment than in the technology-enhanced environment. Students in the traditional setting experienced a boost in their statistics self-efficacy across the semester, whereas their high-tech counterparts reported no self-efficacy change. As has been shown in other studies (Finney & Schraw, 2003), self-efficacy predicted achievement for all students.

Pegah Mathur
Graduate Program: Architecture
Advisors: Traci Rose Rider and Wayne Place
Poster Number: 124

Experimental Design Review for Evaluating the Effect of Lighting Interventions on Patients with Alzheimer's

Alzheimer's disease is expected to become a major public health problem in the U.S. for the aging population. It is projected that in 2050, 65% of the aging population will die of Alzheimer's. This raises the questions of whether and how we are prepared to provide care for this growing population. In this regard, the built environment can have a crucial role in supporting care and cure processes for the disease. Among the environmental variables that impact the provision of care for Alzheimer patients, lighting is especially consequential as it is known as a non-invasive cure method that can stimulate the circadian rhythm and mitigate the issues of sleeping disturbance and agitation. Nevertheless, previous experimental research on this topic is inconclusive since many studies failed to present important variables and strategies used in their experimental designs (e.g. characteristics of the lighting device, time-series design and frequency of the interventions, the amount of light entered into the subject's eyes). This study reviews the existing research on lighting and Alzheimer's to develop a framework that gives structure to the design of experimental research on the effect of lighting interventions on Alzheimer's patients (e.g. variables, contextual factors, control strategies). This framework can facilitate future research on this topic as it enables the researchers to improve the internal validity of their results by improving their research design. Furthermore, this proposed framework can lead to a consistency in defining and using variables, control factors, and applicable findings across different studies to facilitate replication of experimental studies and inform the researcher on the generalizability of the findings.

Rosa Marie McDonald, Traci Rose Rider, and Wayne Place
Graduate Program: Architecture
Advisors: Traci Rose Rider and Wayne Place
Poster Number: 126

Vegetative Shading in Architecture: Bringing Vegetation Within the Building Envelope

Cooling and heating buildings is the largest sector of energy demand in all industries in the United States. (U.S. EIA, 2016) A large amount of heat comes from solar radiation, compromising occupant comfort. While Lee, Han, and Lee illustrated that traditional shading techniques such as overhangs, horizontal, and vertical louvres are efficient for south-facing facades, daylight simulations show that they are inefficient for east and west facades due to low sun angles. (2017, p. 2) Shading devices must be extremely deep, requiring more building material, vertical louvres must be able to rotate for optimization, obstructing views to the outside, and heat absorbed on louvres can enter the space, increasing the cooling demand. There is a plethora of data on the benefits of vegetation for humans in our environments, including creating cooler microclimates, acting as light-filters, reducing energy demand, and promoting healthier occupants (Ali, Patnaik, & Madguni, 2017; Perini, et al., 2011; Pérez, et al., 2014; Stigdotter, 2004). While the vast majority of this research, such as "Ecosystem services and valuation of urban forests in China," is focused on exterior applications of vegetation, most people spend 90% of their time indoors. (Jim and Chen, 2008; Snyder, 1990) This project examines the viability of vegetation as shading within the building envelope and explores ways to leverage the energy-saving and biophilic benefits of vegetation. To quantify the shading efficacy of vegetation, an experiment was carried out to measure solar radiation and visible light passing through a single layer of leaves from plants commonly used in building interiors. The results illustrated that 87-94% of solar radiation and 97-99% of visible light is blocked by a single layer of leaves, providing support for the use of vegetation inside of buildings as shading. Further development is needed to determine how vegetation should be integrated within buildings.

Jinoh Park
Graduate Program: Design
Advisor: Traci Rose Rider
Poster Number: 143

Establishing a Design Guideline for New CCRC Development in North Carolina Addressing How to Maximize Service Responsibility to Clients as a Designer

This research aims to develop a design guideline for the future Continuing Care Retirement Community (CCRC) development. As a type of senior living facility, the CCRC has been the leading trend, offering a full range of care services in one place. As of 2017, there were 59 CCRCs in North Carolina. If the number of CCRCs increases in proportion to the anticipated senior population of 2034, approximately 40 new CCRCs will be built in North Carolina. However, there is no comprehensive regulation or guideline for CCRCs at the federal level addressing facilities and services. This research explores how these new CCRC facilities can perform better for developers by analyzing the current performance of existing CCRC facilities. With a theoretical perspective of program theory, this research 1) reviewed the configurations of revenue structures in CCRCs, 2) outlined a dependable variable of the CCRCs' revenue, 3) identified independent variables to the outlined dependable variable through the North Carolina Department of Insurance archives, and 4) detected specific variables which statistically significant to the dependable variable. As a result, the occupancy rate influences 87.3% on the revenue of CCRCs. Also, by reviewing literature, location, and supportive services effect on decisions for resident relocation. According to the literature review, this research set sample CCRCs: 1) located in North Carolina metropolitan areas and 2) having similar service configurations. In the samples, specific CCRCs having resident units about 250-450 have higher occupancy rate; especially the specific CCRCs recorded 97% occupancy rate, and other CCRCs got 88% occupancy rate on average in Raleigh-Durham-Chapel Hill area; the different occupancy rates are statistically significant. Consequently, design practitioners who design and build CCRCs need to consider the total units for new CCRC development.

Will Reuther
Graduate Program: Industrial Design
Advisors: Percy Hooper and Victoria Chi
Poster Number: 155

Designing Wireless Vital Sign Monitors that Reduce Environmental Distractions and Promote Family-child Interaction for Babies in the Neonatal Intensive Care Unit (NICU)

The neonatal intensive care unit, commonly referred to as the NICU is responsible for the care and monitoring of babies born prematurely or that encounter other complications during birth. Within the NICU there are many specialized devices designed specifically for neonatal patients, and although these devices are necessary they do cause some complications. Studies have shown that over exposure to sound, light, and other environmental distractions from monitoring devices can disrupt babies rest cycles and increase stress levels. In addition, wired devices reduce the amount of contact a child can have with their mothers, an aspect of NICU care that has become increasingly important. With these challenges in mind, the goal of my project is to build on research already conducted at Northwestern University in the realm of wearable sensors, and design a two-part monitoring system for the NICU that monitors ECG, PPG, temperature, and respiratory rate, and allows for more parent child contact and less environmental friction. In order to accomplish this I first started with secondary source research, afterwards I conducted primary source research in the form of focus group studies. I then moved onto brainstorming concepts by sketching, and from there I began to create prototypes and test out my concepts. Some of my findings thus far include learning that ECG, PPG, BP, temperature, and respiratory rate can now be collected wirelessly with accuracy. Another interesting design finding I discovered is that because babies grow at such a rapid rate, the products you design for them have to accommodate many different growth stages. I've also found that the less adhesive used on the skin the better, because of neonatal skin sensitivity. Finally, I've learned that designs used in the NICU setting can be applied to adult populations easier than vice versa.

Mohammad Salamati
Graduate Program: Architecture
Advisors: Wayne Place, Jianxin Hu, and Stephen Terry
Poster Number: 163

Introducing an Integrated Building System with Innovative Skylight Glazing

Daylight is important to the physical and psychological well-being of human beings. If done carefully, daylighting can also be useful in offsetting lighting electricity consumption. Despite all these advantages, people are spending most of their time indoors, deprived of a good quantity and quality of daylight. Therefore, bringing ample quantities of natural lighting into building interiors is crucial to good building design. The main aim of the current dissertation is to produce an integrated building system incorporating an innovative skylight glazing system that improves daylight quality and reduces glare. In this research, by introducing a new type of glazing system, we are going to solve two main drawbacks of skylights in buildings: overheating problem caused by excess solar gains, and adaptation problems associated with glare and extreme variations in light level. For this objective the research process is framed into three distinct steps: 1) Experimentation and Simulation: After the idea development, the optical performance of the fabricated glazing system is characterized through a comprehensive analysis on mock-up and computer simulation. The experiments on a prototype of what the glazing might be proved it is over 98% effective in rejecting the direct beam sunlight. 2) Designing an integrated building system: Based on the outcome of the experiment and simulation, the geometry of the building is designed and optimized in terms of the tradeoffs between structural efficiency, uniformity in the illuminance, low thermal envelope surface area, spatial aesthetics, and cost. 3) Qualitative evaluation of the product: The main purpose of qualitative evaluation is to understand how the designed building system with the innovative skylight glazing affect the users' satisfaction, productivity, and visual comfort. Field observation, survey, and questionnaire are data collection methods in this step and the results will be analyzed and interpreted by statistical methods.

Connor A. Shipway
Graduate Program: Art & Design
Advisor: Todd Berreth
Poster Number: 173

Rocket Builder: Game-Based Learning Forces and Motion

Forces and Motion is that subset of Physics knowledge which deals with the fundamental ideas of movement and momentum. According to the North Carolina Essential Standards for education, this material is taught in seventh grade classrooms--but these abstract concepts can oftentimes be difficult for students to grasp. Rocket Builder is a game-based learning experience intended to act as a supplementary teaching aid for the Forces and Motion section of middle school science curriculums. Using a drag and drop grid interface, students can construct a rocket out of simple components. Next, the student deploys their built rocket into a physics environment which will test the maneuverability of their craft and put their building skills to the test. The game will offer both puzzle-oriented challenges which ask students to demonstrate their understanding of motion concepts, as well as more open-ended sandbox environments which provide an avenue for creativity and free exploration. Rocket Builder seeks to engage and entertain students, while illustrating motion concepts which might otherwise be frustratingly abstract. Developed in the Unity game engine, Rocket Builder currently exists as an Windows application, with ports to touch screen devices planned for the future.

College of Education

Christina Azmy
Graduate Program: Mathematics and Statistics Education
Advisor: Hollylynne Lee
Poster Number: 9

Secondary Mathematics Preservice Teacher Development of Statistics Teaching Self-efficacy

Recent changes in mathematics curriculum in the United States reflect the increasing importance of data analysis and statistical thinking in society. With the addition of statistics standards, and the emphasis placed on conceptual understanding of statistics topics, there is a new need for teacher preparation in statistics education. However, there is evidence that preservice mathematics teachers feel underprepared to teach statistics topics, partially due to the lack of confidence many teachers report in their own understanding of statistics concepts they are expected to teach. This lack of confidence is important as it relates to teaching self-efficacy (TSE), which is important because it has been found to be related to student outcomes. In an effort to end the cycle of teachers and students uncomfortable with statistics, it is especially important for teacher educators in teacher preparation programs and for teachers of statistics to be aware of the implications of the experiences they provide their students. Thus, the objective of this study is to answer the research question: How do preservice mathematics teachers develop their statistics teaching self-efficacy? This is done within the context of a specific intervention aimed at better preparing preservice teachers to teach statistics. A qualitative collective case study is used to understand the full picture of experiences preservice teachers identify as impactful on their statistics TSE. Data in the form of assignments and discussion forums from the online intervention are used, in addition to semi-structured interviews. Analysis coded for themes in types of experiences that were important in statistics TSE development and the nature of expressed statistics TSE beliefs.

Amanda Danks
Graduate Program: Educational Leadership, Policy, and Human Development
Advisor: A. Brooks Bowden
Poster Number: 41

Examining the Costs and Sociological Themes of District-level Approaches to Integrating Digital Learning into Schools

In North Carolina, the goal of public education is to prepare students for success in postsecondary education and the labor market. One approach the state has prioritized, in both policy and funding, is the use and integration of digital learning. There is suggestive evidence that internet access, devices, and personalized learning may improve student learning, teaching efficiency, and parent engagement, all while preparing students for jobs in our ever-changing economy (Bando, Gallego, Gertler, & Fonseca, 2017; Banerjee, Cole, Duflo, & Linden, 2007; Bergman, 2015; Best & Dunlap, 2012). While policy on digital learning forges ahead, little is known about the resources used and effectiveness of these approaches (Milligan & Griffin, 2016; Vigdor, Ladd, & Martinez, 2014). This paper examines the operationalization and resource allocation among five districts to deepen understanding of how digital learning is shifting investments in education. Districts were identified by state-level stakeholders as important cases that represent a range of demographics and urbanicity. Varying policies regarding purchasing, professional development, and financing are analyzed. Thus, this paper contributes contextual information to inform future experimentation and investment in digital learning, with a goal of improving successful scaling up of approaches. Preliminary findings show that while some districts calculate and budget for device refresh cycles and professional development, others rely on sporadic grant funding and in-house technical support to lengthen the life of devices. The convergence of implementation was surprisingly absent as districts vary in how they define and operationalize digital learning. All districts use community input to actualize digital learning in a way that meets the community's concerns, economic needs, and goals for their students. At the same time, communities appear to have made strategic changes to support digital learning. Made clear in this work is that there is no one-size-fits-all implementation of digital learning.

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Graduate Program: Educational Leadership, Policy, and Human Development
Advisor: Alyssa N. Rockenbach
Poster Number: 44

Mom Scholars: The Modern-day Wonder Women

Despite the increase in women entering graduate education, institutional climates lag in providing the support women need as they navigate family, career, and educational goals. Empirical evidence highlights that mothers in academia face a unique struggle in negotiating professional demands and parental responsibilities. While current research has contributed to the discussion of providing more supportive environments, there is less focus on mothers enrolled in full-time doctoral programs. The purpose of this qualitative case study is to illuminate the experiences of mothers of children under the age of 5 who are also full-time doctoral students at Red & White University. Our research questions focus on the supports, barriers, and quality of life that Mom Scholars experience. In this case study we conducted 10 semi-structured interviews of Mom Scholars with children between the ages of 6 months and 4 years old. In order to triangulate the women's experiences, we surveyed faculty and staff members about their experiences working with Mom Scholars. We also evaluated existing institutional policies and regulations related to mothering students at Red and White institution. Our current findings suggest that partners, advisors, and flexible schedules provide key supports. Institutional policies and supports such as parental leave and lactation rooms were critical for helping Mom Scholars navigate their roles as both student and parent. However, childcare, finances, and time created substantial barriers for Mom Scholars. While the quality of life of the women in the study varied as it relates r to how they managed time, made compromises, and integrated personal and professional life, each Mom Scholar identified factors that greatly impacted their quality of life. Through this research we hope to inform policymakers, faculty, staff, and administrators of the experiences of Mom Scholars and further the conversation about students who also assume the role of parents in their graduate education.

Gregory Downing
Graduate Program: Mathematics Education
Advisor: Karen Hollebrands
Poster Number: 47

Leveraging Culturally Relevant Pedagogy in a College Algebra Course

College algebra is a gateway to graduation for many non-STEM college majors (Van Dyken, 2016). Each year, only 50% of students are successful to earn grades of A, B, or C in these courses (Ganter & Barker, 2004). This means that half the students enrolled in this entry mathematics course receive grades of D, F, or withdraw from the course. This is extremely problematic when we couple this with the fact that most college majors require students receive a C or better in this course to make adequate progress toward their degree. The effect of teaching with culture has been shown to have substantial increase in self-confidence and self-efficacy; effectively replacing feelings of failure and alienation that is all too common with the subject of mathematics and students of color (Aronson & Laughter, 2016). Culturally relevant pedagogy (CRP) is founded upon three principles: academic rigor, cultural competence, and sociopolitical consciousness (Ladson-Billings, 1995). The purpose of this research study is to investigate if student outcomes will be improved by participation in a college algebra class at a historically black university, where the instructor uses CRP in the course. In a mixed methods study, two classes of students, an experimental group and a control group received lessons that were grounded in good, rigorous mathematical teaching practices; but the experimental course received lessons specifically grounded in CRP. Students in both groups were asked to complete a subset of questions from each of the following measures: Precalculus Concept Inventory, the Views About Mathematics Survey, and the Youth Survey on Race and Mathematics. Student interviews and classroom reflections were also collected. Preliminary results show that students in the experimental course showed significant quantitative gains on the various measures related to academic achievement and self-efficacy in mathematics.

Megan Ennes
Graduate Program: Science Education
Advisor: M. Gail Jones
Poster Number: 50

Beyond the Child: Building Science Capital and Parent Science Habitus Through Family STEM Programs

Parents play an important role in educating youth, influencing them through family habitus and capital. Capital includes tangible and intangible resources whereas habitus is made up of dispositions that influence behaviors and decision making. Habitus influences the types of activities families engage in together and the types of experiences to which a child is exposed. Early experiences in science play a fundamental role in the development of science interests and career aspirations of youth. This research examined the development of science capital and family science habitus during a year-long, museum-based, STEM program for families from underrepresented groups and low wealth communities. A mixed methods study was conducted. Parent and guardian participants completed the NextGen Scientist Survey pre and post program. Additionally, 12 families participated in intensive case studies. The 44 adult participants were 80.4% female, 19.6% male, 55.4% African American, 19.6% White, 17.9% Hispanic, and 7.1% other. The surveys were analyzed using t-tests. Interviews were coded using a priori codes developed from Community Cultural Wealth Theory which examines different types of cultural capital that build science career aspirations including social, familial, aspirational, navigational, linguistic, resistant, and science capital. The data were also examined for changes in family science habitus. Analyses revealed that the program facilitated changes in all forms of capital except resistant capital and increased the family science habitus of the participants. The results of this study suggest that family STEM programs can positively influence the science capital and family science habitus of the participants. These results provided evidence that by engaging families as a whole, rather than youth as individuals, programs may effectively support youth science interests and career aspirations. Sustained, engaging, family-based, out-of-school programs is one way to approach the need for more youth, particularly women and those from underrepresented groups, to pursue STEM careers.

Kathryn Green
Graduate Program: STEM Education
Advisor: Cesar Delgado
Poster Number: 63

Navigating Cultural Borders: How an Intervention Affected Community College Biology Students' Understanding and Acceptance of Evolution

Evolution is an essential underlying concept in biology. Previous research demonstrates that many obstacles exist that prevent successful teaching and learning about evolution. This research used the theoretical framework of cultural border crossing and its underlying cognitive explanation, collateral learning, to design an intervention for community college students in an introductory biology class for non-science majors. Cultural border crossing explains that learners might encounter extensive differences between their home cultures and the culture of the science classroom and may need assistance in navigating the crossing of these cultural borders. Quantitative and qualitative data was collected to determine how this intervention affected students' understanding and acceptance of evolution. Data shows there was a small positive effect on the students' understanding and acceptance. Qualitative data indicates that the students with religious worldviews were relieved by the way the intervention valued their worldvivews. Five themes emerged from the data: others as influencers of cultural border crossing and collateral learning, The Road to Homo Sapiens as an obstacle, negative emotions related to evolution, a new category of cultural border crossers needed for the framework, and thoughts on sources of knowledge. Results and related themes suggest that more research should be done on how students' cultures influence their learning about evolution and how educators can best facilitate learning among students with various cultural beliefs about the diversity of life on Earth. This research also implies that professional development for educators related to ***The Road to Homo Sapiens*** and teleological thinking would also lead to an increase in understanding and acceptance of evolution by all students. We live in an era in which understanding scientific concepts and principles is vital and this research illuminates further work that can be done to ensure evolution, an essential underpinning of biology, is fully understood by learners of all types.

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Poster Number: 94

The Development of Discourse Facilitation Among Preservice Elementary Teachers: A Longitudinal Investigation

The recently released Standards for Preparing Teachers of Mathematics (AMTE, 2017) point to the need to develop preservice teachers (PSTs) in discourse facilitation. However, facilitating high-quality discourse in a way that impacts learning is difficult (Michaels & O'Connor, 2015), particularly for PSTs (Neergard & Smith, 2012). Therefore, understanding how they develop in their facilitation of mathematical discourse, the very focus of this study, seems particularly important for the work of mathematics teacher educators. Specifically, this study investigated how PSTs in an undergraduate elementary teacher preparation program (TPP) developed in facilitation of discourse (herein referred to as "math talk") over four semesters. Four participants were purposefully selected from a group of 16 who were studied in depth during their TPP and first year of teaching. The four participants were selected because they demonstrated the most "success" (Brinkerhoff, 2003), in comparison to the larger group, in facilitating math talk during the first year of teaching, as measured by an observational protocol (Walkowiak, Berry, Meyer, Rimm-Kaufman, & Ottmar, 2014). We used the Mathematics Discourse Matrix (Sztajn, Heck, & Malzahn, 2013) to code each five-minute segment of four previously video-recorded lessons, one per semester, as to which discourse type on the matrix was primarily represented. We created graphical representations of the codes to make sense of development during the TPP. Findings indicate two of the participants showed progress over time in how they were facilitating math talk while the other two participants' lessons remained relatively similar. This study can spark discussion in our field about how we measure, make sense, and generate developmental trajectories for mathematics pedagogy. Furthermore, the findings point to the importance of understanding factors that influence variation in teacher development. ReferencesAssociation of Mathematics Teacher Educators (2017). Standards for preparing teachers of mathematics. Available online at amte.net/standards.Brinkerhoff, R. O. (2005). The success case method: A strategic evaluation approach to increasing the value and effect of training. Advances in Developing Human Resources, 7(1), 86-101.Michaels, S., & O'Connor, C. (2015). Conceptualizing talk moves as tools: Professional development approaches for academically productive discussion. In L. B. Resnick, C. Asterhan, & S. N. Clarke (Eds.), Socializing intelligence through talk and dialogue. Washington DC: American Educational Research Association.Neergaard, L., & Smith, T. (2012). Comparing beginning teachers' instructional quality growth on subject-specific and global measures. Paper presented at SREE Conference, Washington, DC.Sztajn, P., Heck, D., & Malzahn, K. (2013). Project AIM: Year three annual report. Raleigh, NC: North Carolina State University (Chapel Hill, NC: Horizon Research, Inc).Walkowiak, T. A., Berry, R. Q., Meyer, J. P., Rimm-Kaufman, S. E., & Ottmar, E. R. (2014). Introducing an observational measure of standards-based mathematics teaching practices: Evidence of validity and score reliability. Educational Studies in Mathematics, 85(1), 109-128.

Michelle L. Nugent
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Poster Number: 140

Investigating the Aspects of Active Learning that URM Students Value in Introductory Biology

One teaching strategy with substantial evidence for promoting success and persistence of students in science, technology, engineering, and mathematics (STEM) majors is active learning, but educators and researchers know little about which aspects of this approach students perceive as beneficial. In particular, there is a lack of understanding regarding perceptions of traditionally underrepresented students (URM) including transfer students, first-generation college students, racial minorities, need-based financial aid recipients, members of the LGBTQ community, and students with disabilities. Giving students in these groups a voice is imperative to understand which specific strategies are effective in promoting student success and persistence. Through the lens of social cognitive theory and expectancy-value theory, we investigated which aspects of active learning strategies URM students identify as beneficial for their learning. Over the course of one semester, students in two sections of an introductory biology course, which use active learning strategies, provided feedback on seven different active learning activities. The overall findings in the study indicate that students value activities that enable them to communicate with others for the purpose of negotiating meaning, corroborating their understanding of the content, and applying it to other contexts. Students recognize the value of peer interactions and these become increasingly prominent over the course of the semester, suggesting that establishing trust and building relationships that help foster a learning community are important factors for the effective implementation of active learning strategies. This is a valuable finding, because it contributes to our understanding of how to focus active learning strategies for students in URM groups, and provides a platform for subsequent studies in other STEM fields.

Blain A. Patterson
Graduate Program: Mathematics Education
Advisor: Karen Keene
Poster Number: 144

Real Analysis Mathematical Knowledge for Teaching: An Investigation

Real analysis is a course that nearly all mathematics majors and most mathematics education majors are required to take, which includes topics such as the real number system, functions and limits, topology on the real line, continuity, differential and integral calculus for functions of one variable, infinite series, and uniform convergence. Unfortunately, this course is often viewed by pre-service high school mathematics teachers as daunting and disconnected from practice. The goal of my research is to investigate the relationship between real analysis and classroom teaching so that we can ultimately better prepare our teachers to teach high school mathematics, from algebra through calculus. Specifically, I am considering the following research questions. (1) What connections between real analysis and high school mathematics standards do teachers make in an interview setting? How can these connections be characterized in terms of their mathematical proficiency and mathematical activity? (2) How do the connections teachers make between real analysis and high school mathematics standards influence their mathematical proficiency, mathematical activity, and mathematical context? In order to address these research questions, five high school mathematics teachers participated in task based interviews and were observed teaching two lessons. Written work from the interviews and lesson plans from the observations was collected and the video recordings of the interviews and observations were transcribed so that coding could done using the MUST Framework. The preliminary results of this study suggest that teachers can apply their knowledge of real analysis to help them better explain definitions and algorithms, provide students with representations, examples, and derivations, and use both the curriculum and student knowledge to build understanding. These results may inform the design and instruction of advanced mathematics courses, such as real analysis, so that they are more connected to the practice of actually teaching high school mathematics.

Sarah Egan Warren
Graduate Program: Educational Leadership, Policy and Human Development
Advisor: Michele Bartlett
Poster Number: 185

Former Ballet Dancers' Transfer of 21st Century Skills to Careers as Data Analysts

Much research has been done about the importance of 21stcentury skills; however, because the field of data analytics is so new, extensive studies about graduates of professional science master's programs in analytics are missing. This poster presents the findings from a qualitative research study about the 21st century skills used by former ballerinas in their current careers as data analysts. The purpose of this study is to contribute to the discussion of transferable skills and examine the role of ballet in the lives of these data analysts. Participants of the study were four female former dancers in their mid-twenties to late thirties who had rigorously trained as ballerinas (as defined by training for at least 15 hours per week and dancing en pointe). Main data sources included researcher's field notes and individual semi-structured interviews about (1) the importance of their ballet training to their current work, (2) the skills they developed as ballerinas, and (3) the influence that their ballet training has had on their lives. Using the Partnership for 21st Century Learning's list of 21st century skills as the analytic framework from which a priori codes were drawn, the data were analyzed. The findings indicate that the former ballerinas (1) articulate a distinct connection between the creativity needed for both ballet and data analysis, (2) recognize that their dance training provided them with opportunities to develop transferable skills that they use in their work as data analysts, and (3) suggest that being a dancer influences their identity. These findings can contribute to the ongoing discussion of the role of arts programs in developing skills essential to workplace success. In addition, this study can contribute to research about transferable skills for analytics students in Professional Science Master's programs.

Chang Yuan
Graduate Program: Teacher Education and Learning Sciences
Advisor: Hiller A. Spires
Poster Number: 164

Teaching Disciplinary Literacy in High School Economics Classrooms: A Dual-Case Study

Disciplinary literacy is essential in understanding and studying subject area knowledge. There is a need for more sophisticated and subject-specific literacy instruction to promote students' understandings of more complex reading materials in the subject matters. Literacy researchers have suggested that literacy instruction in middle and secondary schools be supported across content areas by promoting domain specific reading dispositions and skills. Previous research in the field suggests positive results when preparing content area teachers to instruct through a disciplinary literacy approach. Apart from math, science, and history, economics is one area that lacks evidence-based strategies to support disciplinary literacy learning. Grounded in disciplinary literacy and the expert-novice paradigm, a pilot study was conducted that identified and characterized literacy approaches in the field of economics by investigating reading behaviors of four expert economics readers. Based upon findings in the pilot study, this dual-case study, conducted with two purposefully selected teachers from two schools in the southeastern United States, aims to understand and describe how high school economics teachers teach disciplinary literacy in their classrooms. Guided by three research questions, data was collected during a one-month time frame for each participant, including (a) two interviews with one before and one after the observations, (b) a think-aloud, (c) classroom observation field notes, (d) instructional artifacts. The data is analyzed within-cases and across-cases through a pattern coding system. This study intends to add to the knowledge base of disciplinary literacy in economics. Teaching unique structures, language tools and discourse patterns in the field of economics is essential to help students build economic understanding and reasoning. In doing so, students are better prepared to fully and effectively participate in a complex global economy as well-informed workers, wise consumers and producers, rational savers and investors, and well-educated citizens.

College of Engineering

Zeinab Alsmadi, Zainab Alnoamani, Sean Kerrigan, and Daniel Moneghan
Graduate Program: Nuclear Engineering
Advisor: Mohamed Bourham
Poster Number: 4

Coated Barriers and Blended Concretes for Efficient Shielding in Multilayer Drycask Structure

Termination of funding Yucca Mountain nuclear waste repository has changed the long-term plans for storage of used nuclear fuel. While Yucca Mountain project was designed to store drycasks, however, dry storages will continue to be the systems for storage of nuclear spent fuel in the nuclear utilities sites and other selected sites after transporting the casks. Permanent storage in dry casks is expected to continue and serve as much as 300 years. The performance and the survivability of dry storage for expected extended time is necessary to be maintained to secure radiation protection. Drycasks can be in vertical stand-alone or in horizontal vault. Multi-component multi-layered coatings can provide a multi-purpose barrier. Coating of single, doubly and trebly layers comprised of TiN, ZrO_2, TiO_2, Al_2O_3, MoS_2, are among the coatings on SS304, SS316 and A36 substrates representing the inner canister of the drycask. Coated substrates have been tested experimentally for attenuation of gamma ray, as well as modelled in MicroShield. Additionally, the samples were submerged in circulators with salt water brine for corrosion studies. Other test for gamma attenuation has been performed for drycask with an overpack and modelled in MicroShield and Serpent. Configuration of multilayered concentric cask design with inner special glass-oxide layer was structured as the overpack of this design.

Angelyn Arputha Babu John
Graduate Program: Computer Science
Advisor: Rudra Dutta
Poster Number: 10

Cooperative Trajectory Planning in an Intercommunicating Group of UAVs for Convex Plume Wrapping

Trajectory planning in airborne networks is a primary application of Unmanned Aerial Vehicle (UAV) communication. The literature contains algorithms focusing on collision avoidance, intelligent task assignment and path planning among UAVs. Cooperative schemes exist in which the UAVs communicate with each other to reach a consensus on how each vehicle will take up one trajectory at a time efficiently based on its capability. In the last decade, much research is being done to use UAVs to track contamination in the environment, detect fires and even volcanic eruptions. As the plumes are constantly varying in space and time, there have to be efficient guidance algorithms for the UAVs in order to keep track of the shape of the plume. In this study, we survey the literature to explore the currently available trajectory planning algorithms and also the few available plume tracking algorithms. We then propose a cooperative trajectory planning approach for a group of UAVs, through which the UAVs communicate their position estimates and planned trajectories to update each other's trajectory to efficiently wrap around a plume region so that the contamination in the region can be studied.

Nrup Balar[1], Jeromy James Rech[2], Reece Henry[3], Long Ye[3], Harald Ade[3], Wei You[2], and Brendan T. O'Connor[1]
Graduate Programs: Mechanical Engineering[1]; Chemistry, University of North Carolina at Chapel Hill[2]; Physics[3]
Advisor : Brendan T. O'Connor
Poster Number: 12

The Importance of Molecular Weight in Optimizing the Mechanical and Electrical Performance of All-polymer Solar Cells

As organic photovoltaic (OPV) devices reach efficiencies that make them attractive for commercial implementation, it is becoming increasingly important to understand the thermo-mechanical behavior of the active layers to ensure reliable operation. This is particularly important to exploit intrinsic mechanical advantages of polymers to make physically robust flexible solar cells. Currently, high efficiency OPV devices are typically processed by blending a donor polymer with a small-molecule acceptor. These polymer-small molecule films, however, often demonstrate poor mechanical behavior and are prone to fail due to the detrimental effect of the small molecules. All-polymer solar cells (all-PSCs) provide a promising alternative that can be thermally stable, and mechanically robust. However, the mechanical behavior of all-polymer films is dependent upon a number of factors of the individual polymers and interactions between the polymers. Here, we present the mechanical behavior of two high performing all-PSCs consisting of PBDT-TS_1:PPDIODT and PBNDT-FTAZ:$PNDI_2OD$-T_2. We focus on the fracture energy, crack onset strain, and storage and loss moduli of the films, and explore how the film morphology, polymer ratios, and polymer molecular weights impact both mechanical behavior and device performance. We also compare these results to their polymer:fullerene counterparts. We show that the all-PSC active layers can have a number of mechanical advantages over polymer:fullerene films including greater ductility and toughness and discuss the key molecular and morphological features that govern thermo-mechanical behavior. For example, we show that for the PBNDT-FTAZ:$PNDI_2OD$-T_2 system, increasing the molecular weight of each polymer leads to both improved power conversion efficiency and cohesive fracture energy resulting in high performance mechanically robust flexible solar cells.

Joseph J. Cambareri
Graduate Program: Nuclear Engineering
Advisor: Igor A. Bolotnov
Poster Number: 26

Interface Tracking Simulations of Void Fraction Effects in Nuclear Reactor Geometries Supporting Two-Phase Closure Model Development

Turbulent subcooled boiling is highly prevalent in many industrial applications, including the operation of light water reactors (LWR), due to the flow regime's high heat transfer coefficients. While the dynamics behind single-phase flows are generally understood, the fundamentals of two-phase flows are of an order of magnitude more complicated due to the presence of an interface between the phases. High-fidelity two-phase data is required to develop a fundamental understanding of two-phase flow behavior for application to LWRs and broader engineering purposes. Taking advantage of the rapid growth of high performance computing (HPC) facilities, the feasibility of studying practical engineering problems, such as turbulent two-phase flows in LWR geometries, with large-scale first-principle based simulation is ever increasing. Direct numerical simulation (DNS), coupled with interface tracking methods (ITM), has the capability to collect high-fidelity numerical data in complex geometries containing thousands of bubbles and Reynolds numbers that match or exceed high-resolution experimental capabilities. The presented research employs the massively parallel, finite-element based, unstructured mesh code, PHASTA to simulate a series of turbulent bubbly flows in an LWR subchannel with auxiliary structures (spacer grids and mixing vanes). Turbulent two-phase flows are simulated at hydraulic Reynolds numbers of 80,737 with void fractions of 3% and 5% (768 and 1,310 bubbles respectively) and compared against a previously simulated 1% void fraction case (262 bubbles). Of specific interest to this research is the effect of the void fraction upon bubble dynamics and turbulence parameters. With the wealth of numerical data collected, advanced two-phase closure models can be developed to account for the impact of complex geometries and bubble concentrations, demonstrating the unique value of high-resolution simulations acting as "virtual experiments."

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Graduate Program: Chemical and Biomolecular Engineering
Advisor: Orlin D. Velev
Poster Number: 39

Development of Novel Stability Assays for Protein Biopharmaceuticals Using Time-dependent Light Scattering Analysis

We are developing methods for determining protein stability in order to better understand protein aggregation in general, and to eventually improve the shelf-life of biopharmaceuticals at high concentration. Using polyclonal immunoglobulin G (IgG) as a model protein, and dynamic light scattering (DLS) as a tool to determine the size of particles present in solution, we analyze how the rate of aggregation varies with temperature and concentration. Room temperature DLS measurements indicated a slight increase in apparent average hydrodynamic radius as a function of concentration in the 1.25 - 10mg/mL range, but no change in apparent radius was observed after three weeks. To accelerate aggregation, we heated the protein solutions at a constant rate in the DLS instrument, with periodic measurements. While the onset of aggregation was visible with this technique, it was difficult to see differences between samples. In order to see these differences more clearly, we implemented (i) a multimodal analysis, a high resolution fitting analysis ideal for multiple sizes present in a solution, (ii) a temperature ramp to intermediate temperature, followed by a stress test holding that temperature over several hours, and (iii) 3-dimensional plots showing the time-dependent evolution of the particle size distribution at the selected temperature. The resulting 3-dimensional plots have allowed us to see how the onset of aggregation varies with conditions. We expect this method to provide improved understanding of the effects of parameters such as temperature and concentration on the stability of protein solutions.

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Advisors: Jacob Eapen and K. Linga Murty
Poster Number: 42

Tribological Damage Mechanisms in Superalloys

Iron and nickel-based superalloys have long attracted the attention of the academic and industrial research communities as these alloys possess superior thermomechanical properties, especially at high temperatures. Alloys Incoloy 800H and Inconel 617 are currently being considered for the structural and in-core components of the very-high-temperature gas-cooled reactors (VHTR). During normal operation, several components of the VHTR such as fuel handling and control rod drive mechanisms are subjected to fretting. In this study, we investigate the fretting damage mechanisms of Incoloy 800H and Inconel 617 in a simulated VHTR environment. A set of fretting experiments has been conducted on alloys 617 and 800H in air and helium environment by our collaborators at Purdue University. We have conducted several analytical techniques on the tribologically-tested samples to develop a mechanistic understanding of the fretting damage. We have utilized a number of microscopic and spectroscopic techniques including laser confocal microscopy (LSCM), electron microscopy, Raman spectroscopy, and energy-dispersive x-ray spectroscopy (EDS) to investigate the surface and subsurface microscopic features. Preliminary results have shown differences in the topographic character of the wear scars in air and helium. The results of EDS indicate a larger amount of oxidation at higher temperatures in air; we infer that this enhances the wear resistance at higher temperatures. Further, we have identified several oxides that are formed in the wear scar regions including chromium and iron-rich oxides using Raman analysis.

Lingnan Gao
Graduate Program: Computer Science
Advisor: George Rouskas
Poster Number: 56

On Congestion Minimization for Service Chain Routing Problems

Network function virtualization (NFV), with its perceived potential to accelerate service deployment and to introduce flexibility in service provisioning, has drawn a growing interest from industry and academia alike over the past few years. One of the key challenges in realizing NFV is the service chain routing problem, whereby traffic must be routed so as to traverse the various components of a network service that have been mapped onto the underlying network. In this work, we consider the online service chain routing problem with the goal of minimizing the maximum network congestion. To this end, we present a simple yet effective online algorithm in which the routing decision is irrevocably made without prior knowledge of future requests. We prove that our algorithm is O(log m)-competitive, where m is the number of edges of the underlying network topology, and we show that this ratio is asymptotically optimal.

Zheming Gao
Graduate Program: Operations Research
Advisors: Shu-Cherng Fang and Negash Medhin
Poster Number: 57

How to Combine Optimization Theories and Machine Learning: Max-Soft Quadratic Surface Support Vector Machine

As a specific example of pattern recognition, data classification is a popular research area in supervised learning. There are many classification methods are proposed in the literature recently. One of them, the support vector machine (SVM), is an effective and efficient approach which does not require any prior statistical information from the data set. In recent years researchers have been proposing SVM models using different kernels, loss functions or with other assumptions. There are a few kernel-free SVM models in the literature as well, such as the Quadratic Surface Support Vector Machine (QSSVM). This research investigates the robustness of QSSVM and proposes a new QSSVM model from a conic optimization perspective. Instead of evaluating the relative geometric margin measured with all data points, a min-max relative geometric margin was used in the objective function. The soft margin case was considered in this study by adding penalty variables to the objective. In order to keep it consistent and get rid of the matrix variable in the quadratic term, a vectorization technique was applied to both the objective and the constraints. After vectorization, the program could be reformulated as a second order cone programming problem (MAX-QSSVM) and be solved with optimization solvers. (CVX, Cplex, etc.) The MAX-QSSVM model was numerically tested with five data sets in different scale. Compared with kernel-SVMs and other QSSVM models in the literature, the MAX-QSSVM provided a smaller misclassification rate.

Raghav Hampapur Venkatnarayan
Graduate Program: Computer Science
Advisor: Muhammad Shahzad
Poster Number: 70

Enhancing Indoor Inertial Odometry With WiFi

Accurately measuring the distance traversed by a subject, commonly referred to as odometry, in indoor environments is of fundamental importance in many applications such as augmented and virtual reality tracking, indoor navigation, and robot route guidance. While theoretically, odometry can be performed using a simple accelerometer, practically, it is well-known that the distances measured using accelerometers suffer from large drift errors. In this paper, we propose WIO, a WiFi-assisted Inertial Odometry technique that uses WiFi signals as an auxiliary source of information to correct these drift errors. The key intuition behind WIO is that among multiple re?ections of a transmitted WiFi signal arriving at the WiFi receiver, WIO first isolates one reflection and then measures the change in the length of the path of that reflection as the subject moves. By identifying the extent through which the length of the path of that reflection changes, along with the direction of motion of the subject relative to that path, WIO can estimate the distance traversed by the subject using WiFi signals. WIO then uses this distance estimate to correct the drift errors. While researchers have previously proposed to use WiFi signals to correct drift errors, prior schemes suffer from one or more of the following six limitations: they 1) do not work indoors, 2) require manual exhaustive fingerprinting, 3) are not resilient against changes in environment including human movements, 4) do not work on commodity WiFi devices, 5) require multiple access points, and/or 6) can measure distance traversed by humans but not by non-human subjects. WIO addresses all of these limitations. We implemented WIO using commodity devices and extensively evaluated it in a wide variety of complex indoor scenarios on both human and robotic subjects. Our results demonstrate that WIO achieved an average error of 6.28% in estimating the distances traversed by the subjects.

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Graduate Program: Chemical and Biomolecular Engineering
Advisor: Fanxing Li
Poster Number: 71

Light Alkane Valorization to Ethylene via Chemical Looping

Ethylene is commercially produced via thermal cracking of light alkanes, like ethane and naphtha, in the presence of steam. The process involves high temperature (>1100 K) pyrolysis and a large steam generation load, making it highly energy intensive (17-30 GJ/tonne ethylene). It leads to significant amount of NO_x and CO_2 emissions and requires periodic shutdowns for coke burnout. Moreover, single-pass ethylene yield is limited by thermodynamic equilibrium. Oxidative dehydrogenation of ethane (ODH) to ethylene is an efficient alternative. In ODH, the feedstock is partially oxidized into ethylene and water. We propose a chemical-looping ODH (CL-ODH) approach where a metal oxide-based redox catalyst provides oxygen for the ODH reaction from its lattice. The oxygen-depleted redox catalyst is subsequently oxidized in air, regenerating the catalyst and releasing the heat needed for the process. This allows built-in air separation with minimal parasitic energy loss and better temperature control. We have identified that Mg_6MnO_8, a mixed oxide, when promoted with alkali salts, helps produce ethylene with exceptional selectivity. The facile combustion of hydrogen favored by the promoted redox catalyst leads to high ethylene yield providing the heat required for the endothermic dehydrogenation reaction. CL-ODH of these light alkanes is modeled using ASPEN Plus® and is compared with conventional steam cracking processes. Results show that CL-ODH with 85% ethane conversion provides over 80% reduction in the overall energy demand and CO_2 emissions, with over 50% savings, using naphtha as feed. The exothermic nature of the regenerator and elimination of the steam requirement lead to major reductions in the upstream energy consumption. On consuming hydrogen, results from the kinetic model, show increased yields of ethylene and other high-value heavy products. The analyses confirm that light alkane-pyrolysis coupled with selective hydrogen combustion can be potentially effective as a strategy for sustainable ethylene production via CL-ODH.

Zachary Hopkins[1], James McCord[2], Mark Strynar[2], Andrew Lindstrom[2], and Detlef Knappe[1]
Graduate Program: Civil, Construction, and Environmental Engineering[1]; U.S. Environmental Protection Agency[2]
Advisor: Detlef Knappe
Poster Number: 77

Factors Affecting Activated Carbon Adsorption of Recently Discovered Per- and Polyfluoroalkyl Ether Acids

Health implications associated with long-chain per- and polyfluoroalkyl substances (PFAS) have caused a shift in PFAS manufacturing and usage towards shorter-chain PFAS and fluorinated alternatives. Fluorinated alternatives include perfluoroalkyl ether acids (PFEA), in which ether oxygen atoms are incorporated into the perfluoroalkyl chain. PFAS contamination of drinking water sources is a concern because conventional and many advanced treatment processes do not effectively remove PFAS, including PFEA. Our research aims to 1) identify granular activated carbon (GAC) properties that enhance PFAS removal, 2) develop structure-property relationships to predict PFAS removal by GAC, and 3) predict field-scale GAC effectiveness from bench-scale data.Rapid small-scale column tests (RSSCTs) were conducted to compare PFAS removal by three GACs prepared from subbituminous coal and coconut shells. PFAS removal was evaluated from both surface water and groundwater. Samples were analyzed by liquid chromatography – tandem mass spectrometry for 21 PFAS, including 10 PFEA. Among the 21 targeted PFAS, the four least adsorbable compounds were perfluorobutanoic acid (PFBA) and three monoether PFEA with 3, 4, and 5 carbon atoms. PFAS adsorbability increased with perfluoroalkyl chain length and incorporation of ether oxygen atoms. Also, linear PFAS were more adsorbable than branched PFAS of equivalent chain length. GAC effectiveness was strongly affected by the dissolved organic matter content of the water matrix. E.g, 25% PFBA breakthrough was reached after treatment of 6,900 bed volumes in surface water and after 19,400 bed volumes in groundwater. RSSCT data overpredicted field-scale GAC performance, suggesting that PFAS adsorption capacity is dependent on GAC particle size. A PFAS-dependent fouling factor is therefore required to effectively scale up RSSCT data. Results from this study are expected to aid water purveyors in selecting the most effective GAC to treat for PFAS in source water.

Javier Huayta
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Adriana San Miguel
Poster Number: 81

In Vivo* Longitudinal Tracking of the DAF-16 Transcription Factor in *C. elegans

Several environmental factors affect longevity in *C. elegans*, and most of these stressors function through the DAF-16/FOXO transcription factor, which regulates expression of genes involved in aging and stress response. In turn, spatiotemporal activity of these genes alters lifespan and healthspan of *C. elegans*.Tracking longitudinal activity of these aging-related genes is challenging due to the destructive nature of most quantitative gene expression assays. Moreover, microfluidic platforms allow for easy animal handling, immobilization, and imaging of *C. elegans* under controlled environmental stimuli without need of anesthetics and time-consuming manual manipulation.These stimuli affect the localization of DAF-16 in a spatiotemporal basis that is measured through our MATLAB algorithm. By this means, longitudinal *in vivo* tracking of gene activity in response to environmental perturbations is achieved through quantitative analysis of gene expression by fluorescent imaging.The data sets thus acquired are used to relate environmental perturbations, longitudinal gene activity, and healthspan and lifespan. Quantitative mathematical models derived with these data sets will enable elucidating how this lifelong background determines lifespan and healthspan in *C. elegans*. Moreover, in further studies we will explore the effects of other lifespan-altering environmental conditions, and additional key aging pathways affecting *C. elegans*.

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Graduate Programs: Electrical Engineering[1]; Biomedical Engineering[2]
Advisor: Edward Grant
Poster Number: 90

Cloud Enabled Autonomous Wheelchair for MND Patients

Machine learning (ML) and artificial intelligence (AI) are currently being used extensively for systems such as autonomous cars and drones. Here, ML technology is applied in a bio-medical robot application. Autonomous intelligent power wheelchairs are proving to be of great assistance for patients with rare diseases, like Motor Neuron Disease (MND), who gradually lose their sensory perception and control capabilities over time. The goal was to develop a smart wheelchair that would extend their quality of life. Here, voice control became a focus; because these patients' speech deteriorates over time. So, a cloud-based deep neural network (DNN) was designed to classify patient's accents. The direction of arrival (DoA) of voice commands was determined for a strong guttural accent, to represent changes in an MND patient's speech pattern over time. This developed controller, in addition to the wheelchairs ability to avoid obstacles and navigate through an indoor environment using Kinect and LiDAR sensors, provided robust localization and navigational control of the wheelchair. The overall system was designed to utilize cloud-based technology, to classify the accents based on the voice features using a DNN, and to determine the DoA with respect to the wheelchair and assist the navigation. The experimental results show the wheelchairs performance to be robust and accurate.

Amanda L. Karam, Yi-Chun Lai, Francis de los Reyes, III, and Joel Ducoste
Graduate Program: Environmental Engineering
Advisors: Francis de los Reyes, III and Joel Ducoste
Poster Number: 93

What Light Through Yonder Bioreactor Breaks? Modeling Light in Photobioreactors for Micro Algae Cultivation

Capturing the effect of light in kinetic models that predict the growth of microalgae in photobioreactors (PBRs) is challenging due to the dynamic changes in light intensity over space, and the interactive impacts of algal growth and algal biocomponents. This challenge is further complicated by the inconsistent and wide-ranging modeling approaches used to estimate light. The objective of this research was to evaluate many of these various modeling approaches, specifically those that use the Beer-Lambert law, by calibrating and validating these models using a continuous, in-situ photosynthetically active radiation (PAR) light sensor within a flat-plate PBR. Dunaliella viridis microalgae was grown under various light and nitrogen conditions and measurements of biomass and pigments were used, as needed, for calibrating and validating seven different light models. Overall, light models that included the absorbance of both biomass and chlorophyll pigments had better predictive power (5-6% error) than models that included only biomass (30% error) or only pigments (23-26% error). These results suggest that current light modeling approaches for estimating light within microalgal systems should shift towards models where both chlorophylls and biomass absorbing constituents are consistently included.

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Graduate Programs: Civil, Construction and Environmental Engineering[1]; Electrical Engineering and Computer Science, University of Michigan, Ann Arbor[2]; Building Automation Systems, University of Michigan, Ann Arbor[3]
Advisor: Jeremiah Johnson
Poster Number: 96

Buildings as Batteries: An Experimental Investigation Into Energy Efficiency Impacts of Demand Response

There is an increasing need for flexible resources to maintain reliable power grid operation due to the combined effect of reduced grid inertia and the addition of supply-side stochasticity caused by renewable sources such as photovoltaic solar and wind. Commercial building heating ventilation and air conditioning (HVAC) systems are attractive candidates for load shifting due to their large thermal inertia and inherently sophisticated building controls. Recent work has suggested potential adverse impacts on energy efficiency associated with such demand response activity. To explore this phenomenon, we conducted over one hundred experiments on three university buildings. We perturb the building temperature setpoints in predefined patterns, causing the building to change its power consumption over and below its baseline power use, thereby acting like a battery from the grid's perspective. This emulation of energy neutral demand response events is then used to assess the impact of the tests on overall building energy efficiency. We developed novel metrics to assess the building performance and evaluated the performance of various demand response signal designs. We present results from the experiments and quantify the efficiency of building response by focusing on the round trip efficiency as well as the additional energy consumed by the building while providing this demand response service. The three buildings respond with mean roundtrip efficiencies ranging from 34% to 81%, with individual tests yielding efficiencies far outside that range. We also find that the efficiency of building response depends on the magnitude and polarity of the temperature setpoint changes. Our results are consistent with past experimental results, but inconsistent with past modelling results. Our findings offer new and practical insights into the impacts of demand response on building operations and potential challenges needed to be overcome to achieve commercial viability.

Dennis T. Lee
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Gregory N. Parsons
Poster Number: 109

Chemical Protective Textiles as Functional Platforms for Clean Technology

A variety of chemical weapons are posing an increasing threat not only to military populations but also to civilians since World War I in 1917. Although commercially available activated carbon-based adsorbents have been used to physically sequestrate such hazards, their short shelf-life and substantially falling adsorptive performance as used still does not relieve people from personal security and safety to date. This critical global issue motivates us to work on fabricating protective functional platforms into which exceptionally porous, tunable, and stable metal-organic frameworks (MOFs) are integrated. In this study, we create flexible non-woven textiles functionalized with Al-PMOF, consisting of $Al(OH)(CO_2)_2$ metal clusters bridged by porphyrin linkers (H_2TCPP), and identify their catalytic performance for detoxifying 2-chloroethyl ethyl sulfide (CEES), a simulant of sulfur mustard. The Al-PMOF/fiber textiles are synthesized by our facile synthetic strategy where Al2O3 thin film is conformally deposited onto polymeric fibers via atomic layer deposition (ALD), followed with solvothermal reaction with H_2TCPP in an optimized ratio of DMF and water cosolvent system. We find, on a per unit mass of MOF basis, the surface-immobilized Al-PMOF thin films substantially improve CEES detoxification turn-over-frequency (molCEES·molchromophore-1·min-1) by a factor of 19 compared to their bulk powder counterparts prepared via a conventional solvothermal method. To the best of our knowledge, the catalytic performance out of fiber-surface-bound Al-PMOF thin film is the most efficient among other MOF thin film systems reported. In addition, the use of chemical protective textiles is proved to be extended to other practical applications including a colorimetric pH sensing and a selective removal of chloroform contaminants from water.

Landon K. Mackey
Graduate Program: Electrical Engineering
Advisor: Iqbal Husain
Poster Number: 115

Protecting Distributed Renewable Energy Resources with Direct Current Circuit Breakers

A paradigm shift from alternating current (AC) to direct current (DC) is taking place at increasing rates. Energy loads such as LED lighting, computers, and motor drives are growing in popularity while DC energy resources such as photovoltaic systems, battery energy storage, and off-shore energy harvesting are expanding exponentially. Achieving fast and efficient circuit protection is critical to DC system safety, with scholars focusing on hybrid direct current circuit breakers (DCCB) to facilitate next-generation DC distribution systems. However, fault isolation in distributed renewable energy systems requires additional protection and speed that is not yet available for medium-voltage DC systems. NC State University, in collaboration with the North Carolina Coastal Studies Institute, is addressing DC system protection challenges with high speed, high efficiency, medium-voltage DCCB devices and DC Microgrid protection coordination strategies. In our work, DC system dynamics are explored using advanced computer modeling, simulation, and laboratory experimentation. The discovered DC system characteristics facilitated the design and construction of a new ultra-fast mechanical switch and an advanced solid-state switch control scheme to develop a bidirectional, millisecond-level, hybrid DCCB. Our coordinated operation of the new mechanical and solid-state switches is capable of fault isolation in medium-voltage DC systems in under two milliseconds. This vastly improves upon the 60 millisecond actuation time of prior-art electromechanical circuit breakers. The new hybrid DCCB design and control system is being produced in conjunction with other facilitating technologies to develop a next-generation smart DC Microgrid distribution system. This bidirectional, medium-voltage distribution system enables harvesting clean and sustainable energy from the wind, sun, and ocean while promoting a more robust and adaptive infrastructure to ever-changing global energy needs.

Atchyuta Manda
Graduate Program: Industrial Engineering
Advisor: Reha Uzsoy
Poster Number: 118

Optimizing Releases During New Product Introductions

The adverse impact of new product introductions on the performance of semiconductor wafer fabrication facilities (fabs) is widely acknowledged. We consider the problem of determining optimal releases over time for a new product being introduced into a wafer fabrication facility currently producing an existing product. The problem is formulated as a non-linear, non-convex release planning model that captures the impact of the new product introduction on the effective processing time of the production line. It also incorporates the learning effects gained as experience in producing the new product accumulates. We solve this formulation using a genetic algorithm and enhance the quality of the solution obtained by providing the algorithm with a good initial solution population using an approximate nonlinear convex formulation. Examination of the structure of the optimal solution provides insights into the relationships between the different costs involved in the model. Computational experiments show that the methodology produces high-quality solutions in reasonable CPU times. Comparisons to two benchmark policies show the optimal solution shows a significant reduction in backorders and an increase in total revenue.

Brett A. McCandless
Graduate Program: Mechanical Engineering
Advisor: Hsia-Ying Shadow Huang
Poster Number: 125

Investigation, Modeling, and Reconstruction of the Tendon-to-bone Insertion Tissue

The tendon-to-bone connective tissue, also called the insertion region or enthesis, is a highly specialized tissue connecting the two very dissimilar materials of tendon and bone. The insertion is a complex, composite, biomaterial junction that allows for efficient stress transfer between these two materials, whose elastic moduli differ by a factor of nearly 50. Studying this connective tissue is a relatively new phenomenon, for although tendon and bone are each well studied, the insertion region is not. As such, few models have been developed for use in studying the tendon-to-bone insertion tissue, and these models are often extremely limited in scope, either in dimensionality or through significantly simplifying or homogenizing assumptions of this complex, inhomogeneous tissue.It is known that many constitutive materials populate the enthesis, such as an assortment of collagen fibrils, fibroblasts, elastin, proteoglycans, osteoblasts, osteoclasts, and osteocytes, among others, but specific contributions of these materials and their arrangements to the mechanical properties of the enthesis at large are not known. A model is to be developed utilizing the intricate microstructure of the insertion region. To do this, a FIB-SEM was used to mill serial sections of the insertion region. Images were taken after each milling iteration, and these images were stacked in ImageJ to create a 3D rendering of the insertion tissue. This rendering is to be imported into ANSYS and properties assigned to all constituent materials contained in the microstructure of the enthesis. The use of micro-computed tomography obtained relative material properties throughout the region, and these property values, coupled with data obtained from previous experiments, are to both be used to assign material properties to constituent materials within the insertion model. This model is necessary for better understanding of the mechanisms by which the insertion dissipates stress between tendon and bone. This understanding promotes better insight into the mechanisms by which to connect two highly dissimilar materials.

Amie McElroy
Graduate Program: Civil Engineering
Advisors: Detlef Knappe and Michael Hyman
Poster Number: 127

Cometabolism of 1,4-Dioxane at Concentrations Relevant to Drinking Water Treatment

The cyclic diether 1,4-dioxane occurs widely in drinking water sources. It is a likely human carcinogen, and health goals for drinking water are as low as 0.25 µg/L in the US. Conventional drinking water treatment processes are ineffective for 1,4-dioxane control. Reactive radical species can oxidize 1,4-dioxane, but their generation is energy intensive. Biological treatment is a promising alternative for cost-effective 1,4-dioxane control, but its effectiveness has not been established at low µg/L concentrations. Objectives of this work are to (1) develop and characterize enrichment cultures that cometabolically degrade 1,4-dioxane at low µg/L concentrations and (2) identify impacts of sorptive capacity of filter media, empty bed contact time (EBCT), and primary substrate on 1,4-dioxane removal in biofilters. Cultures were enriched from North Carolina rivers and treatment plants using isobutane as the primary substrate. Enrichments rapidly degraded 1,4-dioxane from 100 µg/L to <0.25 µg/L in a resting cell assay. Based on 16S-rRNA amplicon sequencing data, commonly enriched taxa included Mycobacterium and Variovorax. Activity-based protein profiling (ABPP) results suggest all enriched cultures expressed a similar polypeptide, which is likely linked to the expression of short-chain alkane monooxygenase (SCAM). Inhibition assays indicated that monooxygenase is required to initiate 1,4-dioxane degradation.To determine the impact of design and operating parameters on the effectiveness of biofilters, 1,4-dioxane removal in inoculated filters will be compared to non-inoculated controls. Filter media with different 1,4-dioxane capacities will be evaluated (anthracite, activated carbon, carbonaceous resin). Four EBCTs will be considered, 7.5 to 30-minutes. Active filters will receive butane or a food-grade additive as primary substrate. Furthermore, I will explore ABPP to determine if SCAM is produced in biologically active filters and is an indicator of 1,4-dioxane removal efficiency.

Hamed Mohammadbagherpoor
Graduate Program: Electrical Engineering
Advisor: Edward Grant
Poster Number: 132

Closed-loop Control of a Magnetically Actuated Fiber-coupled Laser for Computer-assisted Laser Microsurgery

Patient outcomes in the medical field are improving through the use and incorporation of robotics technology and laser physics, e.g., the use of optical fibers and lasers in micro-surgery. This enables fast and efficient laser ablation procedures to be conducted with reduced levels of thermal damage to healthy tissue occurring. The benefits obtained through using lasers in soft tissue surgeries include: (1) improved post-operative functionality, (2) decreased morbidity (disease), (3) better homeostasis (coagulation, changing blood from a liquid to a gel), and (4) minimal peripheral tissue injury. This poster describes the design and implementation of a new optical fiber laser micro-surgery system, one that is the first to use closed-loop feedback control. In this computer assisted laser scanning tool the laser beam is controlled by four magnetic actuators. After attaching permanent magnets to the free end of the optical fiber, it is the control of these four magnets that produces an accurate laser scanning system, one suited to micro-surgery applications. The interaction between the electromagnetic fields generated by the external magnetic coils and the flux of the internal permanent magnets, produces the torques to control the desired movement of the optic fiber. The tracking error of the optic fiber is compensated for by using a photo-detector sensor as the feedback transducer in the control system. The magnetic torque bends the optical fiber and the feedback from the photo-detector gives automated control and high-speed laser scanning of the fiber tip. The simulation and the experimental results are accurate and are co-related.

Ariadne L. Palma Parra
Graduate Program: Civil Engineering
Advisor: Mervyn J. Kowalsky
Poster Number: 142

Influence of Spectra Definitions on the Bidirectional Response of RC Bridge Columns

Ground motions are recorded by triaxial accelerometers that measure acceleration in three orthogonal directions: two in the horizontal plane and one in the vertical. Design spectra for a specific location are based on historical bi-directional horizontal acceleration records. For a specific ground motion recording, the response spectrum can be generated for each component. However, it is necessary to account for all possible angles in which the ground motion could occur. The currently used response spectrum definition, RotDnn, is independent of the in-situ orientation of the sensors by taking into account spectral amplitudes over all possible rotation angles. The two fractiles are the median, RotD50, and the maximum, RotD100. Recent changes in building codes motivate the need for understanding the impact of using a specific definition in design. The NGA-West2 research program has developed models based on RotD50, which predict the median spectral acceleration of ground motions. However, for building code committees in the US have decided to adopt the maximum percentile, RotD100, as the definition of the hazard for design. Concerns have been raised regarding the choice of the maximum definition, given that the principal axes of typical buildings may not align with the maximum direction during an earthquake. This research aims to evaluate the response of SDOF bridge structures, such as reinforced concrete circular columns, designed for seismic hazards represented by response spectra given by RotD50 and RotD100. Furthermore, it will also provide verification of the Direct Displacement-Based Design approach for bidirectional loading. Thus far, the data suggest that on average structures designed to RotD50 achieve displacements that were 20% greater than the target displacement used in their design, while the RotD100 designs were within 5% of their target. After concluding the SDOF bridge systems, examination of multi-span bridge systems will be essential before final recommendations are proposed.

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Graduate Programs: Chemical and Biomolecular Engineering[1]; Eastman Chemical Company, Kingsport, TN[2]; Fiber and Polymer Science[3]; Materials Science and Engineering[4]
Advisors: Erik Santiso and Saad Khan
Poster Number: 149

Multi-Scale Modeling of Polymer Resins, Thermosets, and Fibers

We model structural and thermophysical properties of polymeric systems using computational approaches from the molecular to the macroscopic scales. Our models and simulations are used to (i) predict the glass transition of polymer resins, (ii) model the kinetics and structure development in thermosets, and (iii) estimate the mechanical properties of polymer fibers. Predicting the glass transition temperature (Tg) is important for polymer processing and performance considerations. We predict Tg using molecular dynamics simulations with a top-down coarse-graining method that requires minimal thermodynamic data of the monomers as input. Further simulations performed according to a design of experiments approach result in a novel, empirical correlation for Tg based on monomer identities and polymer chemical composition. For thermosets, examples of chemically cured and cross-linked network materials, we model the curing process according to experimental kinetic data. We then incorporate this kinetic model into molecular dynamics simulations and analyze the dynamics of network structure development. In the specific case of thermoplastic polymer fibers, we model key physical and chemical structure factors including (i) polymer chemistry, (ii) molecular weight distribution, (iii) crystallinity, and (iv) molecular orientation. We use united atom models to simulate mechanical properties and develop constitutive models for use in continuum-level simulations. Our computational modeling of polymeric materials pinpoints structure-property relationships that allow for optimized design of materials for specific applications.

Eshwar Ravishankar
Graduate Program: Mechanical Engineering
Advisor: Brendan O'Connor
Poster Number: 210

Design and Integration of Organic Solar Cells with Greenhouses

Organic photovoltaics have several advantages over other solar cell technologies that include the ability to tune absorption characteristics through material synthesis and device design and the ability to make semitransparent devices with a broad range of transmittance across the solar spectrum. One promising application is to integrate semitransparent organic solar cells with greenhouses. Greenhouses provide a controlled environment for plant growth that results in significant increases in yield while reducing water consumption compared to conventional farming. However, greenhouses typically require significantly more energy per kg of food produced. Reducing the need for energy input can lower the cost of greenhouse-produced food and enable production in a greater number of geographical locations. Given this desire, there has been interest in solar powered integrated greenhouses for over a decade. However, the incorporation of traditional Silicon-based solar panels has shown poor performance due to the complete shading by these opaque panels. Here, we discuss the opportunity provided by semitransparent organic solar cells. The semitransparent solar cell absorption spectrum can be tuned to complement the absorption of plants rather than compete for the same light resulting in an opportunity to generate power without hindering plant growth. In this work, we show how the incorporation of semitransparent organic solar cells into greenhouses impacts the plant growth, power produced, and overall energy balance of the greenhouse. We use detailed models determined optimized solar cell designs and deployment strategies for various greenhouse geographical locations across the US. Furthermore, we experimentally demonstrate the modified growth behavior of red leaf lettuce under various semitransparent solar cells. Among the results, we show that the right combination of bulk heterojunction materials results in similar or improved fresh weight of red leaf lettuce over its complete growth cycle compared to plant growth without solar cell coverage, highlighting the potential of this application.

Karl Schuchard[1], Behnam Pourdeyhimi[2], Matthew Fisher[3], and Rohan Shirwaiker[1,3]
Graduate Programs: Industrial and Systems Engineering[1]; Wilson College of Textiles[2]; Biomedical Engineering[3]
Advisor: Rohan Shirwaiker
Poster Number: 166

Investigating Process-structure Relationships of 3D-MeltBlowing for Tissue Engineering Applications

Engineered tissue scaffolds should mimic both the micro-architecture and 3D macro-geometry of the native tissues that they intend to substitute. This study focuses on the characterization of 3D-meltblowing (3DMB), a new biofabrication process that enables the creation of such bio-mimicking scaffolds by synergistically combining polymer melt blowing fiber formation principle with a temporo-spatially controlled rotating collector comprising a 3D biomodeled cavity. The effects of two critical 3DMB process parameters – collector surface speed and fiber deposition location relative to the central axis of rotation – on critical quality attributes including structural and biocompatibility characteristics of fibrous Polycaprolactone scaffolds were investigated using design of experiments. Results show that the interaction of surface speed and central axis offset had a significant effect on the fiber diameter ($p < 0.05$). Surface speed and central axis offset also had significant primary effects on fiber angle coherency ($p < 0.05$). This study also characterized differences in Young's modulus and yield strength between the groups. In addition to fiber and mechanical characterization, scaffolds from two groups with significantly different architectures identified from the first study were assessed for responses of living cells over time. Results show that the scaffold architecture and time point had a significant interaction effect on cell viability and metabolic activity ($p < 0.05$). This study demonstrates the early capabilities of 3DMB to fabricate biocompatible tissue scaffolds of relevant clinical thickness and geometry while characterizing the effects of two critical 3DMB process parameters on scaffold quality attributes.

Pratik Sen[1], Ruonan Yang[2], Michael Kudenov[2], and Brendan O'Connor[1]
Graduate Programs: Mechanical and Aerospace Engineering[1]; Electrical and Computer Engineering[2]
Advisor: Brendan O'Connor
Poster Number: 169

Polarization Sensitive Photovoltaics: Design, Processing and Characterization

Organic materials have shown promise in the area of photodetection due to their ease of processing, large photocurrent yield and tunable absorption spectrum. The ability to align the transition dipole moment along the backbone of these polymers has allowed for inducing polarization sensitivity into these detectors. In this presentation we will demonstrate the ability to cascade a series of these semitransparent detectors to fabricate a polarimeter capable of measuring the 2-D Stokes parameter of light, this technique improves on the current state of the art techniques by measuring the complete state of polarization at a single spatial location within a single integration time. Here, we will discuss processing strategies to fabricate these devices and the unique advantages of this approach for optical detection. The fabrication processing discussed will include the alignment of the active layer and the integration of semitransparent electrodes. We will also discuss the use of polymer-small molecule and all-polymer photodetector active layers to tune the absorption spectrum of the photodetectors from narrow band to panchromatic polarization detection. Finally, we will discuss the individual photodetector performance as well as the performance when integrated into a full-Stokes polarimeter.

Christopher T. Straub, Piyum Khatibi, and Robert Kelly
Graduate Program : Chemical and Biomolecular Engineering
Advisor: Robert M. Kelly
Poster Number: 184

Direct Conversion of Transgenic Poplar Trees to Biofuels and Biochemicals

The primary challenge in generating renewable fuels from plant based feedstocks is the ability of the microorganism to access the abundant carbohydrate content of the complex biomass which contains lignin and other structural components complicating carbohydrate access. Even with thermal, chemical, and enzymatic treatments that can account for more than 25% of commercial process costs, typical carbohydrate conversion to product has remained at about 50%.This barrier has been overcome by pairing a transgenic line of poplar trees to a natural lignocellulose degrading extreme thermophile, *Caldicellulosiruptor bescii* (Topt = 78°C). The transgenic poplar trees have been engineered to not only contain lower lignin content but modifications to lignin structure and monomer ratio. With untreated poplar trees as the sole carbon source, *C. bescii* was able to improve carbohydrate conversion from 25% with the wild type poplar to nearly 90% with the transgenic poplar lines. In addition to high conversion of these transgenic plants, *C. bescii* must be engineered to produce a valuable fermentation metabolite. Its native products, acetate and lactate, are of low value and difficult to separate from water. *C. bescii* has been previously engineered to produce ethanol at 60-65°C and we additionally developed and installed a pathway to produce acetone at 70°C.Here we demonstrate the ability to of a bacterium, *C. bescii*, to convert untreated lignocellulosic biomass to industrially useful biofuels and chemicals at high conversion. Ongoing improvements in titer and product selectivity are pushing this promising technology toward viability on a commercial scale.

Ran Tan, Rada Chirkova, Vijay Gadepally, and Timothy G. Mattson
Graduate Program: Computer Science
Advisor: Rada Chirkova
Poster Number: 189

Enabling Query Processing Across Heterogeneous Data Models: A Survey

Modern applications often need to manage andanalyze widely diverse datasets that span multiple data models. Warehousing the data through Extract-Transform-Load (ETL) processes can be expensive in such scenarios. Transforming disparate data into a single data model may degrade performance. Further, curating diverse datasets and maintaining the pipeline can prove to be labor intensive. As a result, an emerging trend is to shift the focus to federating specialized data stores and enabling query processing across heterogeneous data models. This shift can bring many advantages: First, systems can natively leverage multiple data models, which can translate to maximizing the semantic expressiveness of underlying interfaces and leveraging the internal processing capabilities of component data stores. Second, federated architectures support query-specific data integration with just-in-time transformation and migration, which has the potential to significantly reduce the operational complexity and overhead. Projects that focus on developing systems in this research area stem from various backgrounds and address diverse concerns, which could make it difficult to form a consistent view of the work in this area. In this survey,we introduce a taxonomy for describing the state of the art and propose a systematic evaluation framework conducive to understanding of query-processing characteristics in the relevant systems. We use the framework to assess four representative implementations: BigDAWG, CloudMdsQL, Myria, and Apache Drill.

Barbara V. Farias
Graduate Program: Chemical and Biomolecular Engineering
Advisor: Saad A. Khan
Poster Number: 51

Multicomponent Self-assembled Gels for Skin Care Applications: Rheology, Lubrication and Interactions

Polymers that form microgels are widely used in personal care products, where they are added in oil/water emulsions as part of the continuous phase. In the emulsification process, phospholipids can replace traditional surfactants to prevent skin irritation and provide biocompatibility by forming a lamellar structure akin to the skin. Herein, we investigate how the type of microgel forming polymer (hydrophobically modified polyacrylic acid lightly crosslinked (HMPA) versus hydrophilic polyacrylic acid highly crosslinked (PA) behave in an aqueous medium by themselves, in the presence of hydrogenated phosphatidylcholine phospholipids and in emulsions. We examine the effect of composition on the rheological and tribological characteristics. For rheology, we examine behavior of the systems in the linear and non-linear regime using small strain amplitude as well as large amplitude oscillatory shear (LAOS) experiments. We observe all systems to be gels with the elastic modulus (G') dominating and frequency independent, and to exhibit yield stress. Systems containing HMPA show lower yield stresses and moduli than systems with PA, due to the difference in the crosslinking density. However, systems containing HMPA form a more interconnected network in an emulsion than in an aqueous environment due to hydrophobic interactions between the polymer and the phospholipids. Such interactions are verified by measuring the heat of interaction through isothermal microcalorimetry. For tribology experiments, we use a ball-on-disk configuration to obtain friction curves in a range of entrainment speeds using different substrates to mimic the skin surface (PDMS and BioskinTM). We find friction coefficients to be dictated by hydrophobicity of the substrate and polymer used at lower entrainment speeds, by substrate roughness at intermediate entrainment speeds, and by breakdown of the oil phase in the high entrainment regime. These results, taken together provide physical insights to tune and control the bulk rheological and surface frictional behavior of these microgel systems.

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Graduate Program: Civil Engineering
Advisor: Joel J. Ducoste
Poster Number: 194

Dynamic Modeling of *Dunaliella viridis* Growth and Storage Molecule Production Under Various Light and Nitrogen Conditions

In order to optimize the biofuel production, mathematical models have been developed to facilitate a better understanding of the algal growth and lipid production in response to different operational conditions. Yet, most prior models lack regulatory mechanisms to dynamically characterize the photosynthesis and carbon allocation processes under transient light and nitrogen conditions. In this work, we established a new dynamic model to characterize and predict the behaviors of *Dunaliella viridis* cultivated under wide-ranging light and nitrogen conditions in a lab-scale photobioreactor (PBR). We simulated the concentrations of functional biomass, carbohydrates, neutral lipids, chlorophyll a, and extracellular nitrate. In addition, we simulated the time-changing light intensities inside the PBR to account for the effect of light attenuation. We used eleven experimental sets including four different initial light intensities and ten different initial nitrate concentrations (categorized into high and low levels) to calibrate and validate the proposed model using 65% and 35% of total data, respectively. We conducted the identifiability, uncertainty, and sensitivity analyses to demonstrate the model reliability. The posterior distributions of estimated model parameters as well as the credible and prediction intervals of model outputs were obtained using the Markov Chain Monte Carlo (MCMC) method. Our modeling results demonstrated good agreement with the experimental data. Overall, we improved the simulation of photosynthesis dynamics, developed a novel light- and nitrogen-regulated mechanism to describe carbon allocation for lipid production, and provided new strategies for modeling the chlorophyll a and nitrate uptake. We further evaluated the effects of light and nitrogen on the dynamics of the photosynthesis-irradiance relationship, carbon fixation rate, storage pool carbon growth rate, and lipid production rate. Compared to prior literature, our proposed work offers a more comprehensive modeling strategy for simulating the dynamics of the underlying algal bioprocesses under various light and nitrogen conditions.

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Advisor: Veronica Augustyn
Poster Number: 171

Effect of Adscititious Water on the Mechanism of Mg^{2+} Intercalation in Tungsten Oxides from Non-aqueous Electrolytes

There is a high demand for low-cost energy storage devices with high energy density and excellent safety. Rechargeable magnesium batteries (RMBs) have the potential to achieve better performance than Li-ion batteries (LIBs) as they allow for the use of a dendrite-free Mg anode, which has about five times the volumetric capacity of the graphite anode in LIBs. One challenge for Mg-ion batteries is to improve the intercalation kinetics of oxide-based cathode materials. The addition of water in non-aqueous electrolytes has been shown to improve the kinetics of Mg^{2+} intercalation, but the mechanism and the effect of water concentration are still under debate. To shed light on these issues, this research focuses on a systematic addition of water into a 0.1 M $Mg(ClO_4)_2$ in acetonitrile electrolyte and its effect on Mg^{2+} intercalation in WO_3 and $WO_3 + H_2O$. Cyclic voltammetry (CV) was used to analyze the electrochemical performance. Solid-state 1H nuclear magnetic resonance spectroscopy (NMR) and inductively coupled plasma–optical emission spectrometry (ICP-OES) were used to study the intercalation mechanisms in the cathodes. Solution 1H NMR and molecular dynamic (MD) simulation were used to understand the water solvation effect in the electrolytes. An improved rate capability as a function of sweep rate and a decreased peak separation of the redox couples for both materials were found as more water was introduced to the electrolyte until the water concentration reached around 14,000 ppm. Based on these studies, we find that the most likely intercalation mechanism from these electrolytes is the co-intercalation of Mg^{2+} and H^+. The protons were not present in the electrolyte, which means they were likely to be generated at the interface through hydrolysis. This mechanism can be general to other oxides benefitting from the addition of water into non-aqueous multivalent electrolytes.

Shivpal Yadav
Graduate Program: Civil Engineering
Advisor: Akhtar Tayebali
Poster Number: 203

Quantifying Moisture Damage in Asphalt Mixtures

Moisture damage is one of the major concerns in asphalt concrete mixtures. Moisture damage mostly occurs due to two mechanisms–adhesive failure between aggregate and asphalt, and cohesive failure within asphalt binder. There is a need for a test method or conditioning procedure that can be used to measure the adhesive and cohesive behavior of mixtures. The most commonly used test to evaluate moisture sensitivity, tensile strength ratio (TSR) test uses AASHTO T 283 conditioning which has been shown to mostly determine the adhesive failure. Another conditioning method that can be used with the TSR test is the Moisture Induced Stress Test (MIST) conditioning which determines both the adhesive and cohesive failure. The main objective of this research study is to quantify adhesive and cohesive damage due to moisture in asphalt mixtures. This research study used two test methods to determine moisture sensitivity of asphalt concrete–Boil Test with a color measuring device, and TSR test with two different types of conditioning–AASHTO T 283 and MIST conditioning. Percentage stripping from the boil test using the colorimeter device, tensile strength ratio value and percentage volume change using AASHTO T 283 and MIST conditioning were used to evaluate moisture damage. The results from this study show that percentage stripping from boil test and percentage volume change due to the MIST conditioning can be used to quantify adhesive and cohesive damage respectively in asphalt mixtures. Preliminary limits of a maximum of 5.0% stripping from boil test and a maximum of 1.5% volume change due to the MIST conditioning are suggested.

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Poster Number: 154

Degradation of Perfluoroalkyl Ether Acids (PFEAs) in the Total Oxidizable Precursor Assay and by UV/H_20_2

Per- and polyfluoroalkyl substances (PFASs) are widely used anthropogenic chemicals. Two long-chain PFASs, perfluorooctane sulfonate and perfluorooctanoic acid, were historically produced in large quantity, but a manufacturing shift towards short-chain PFASs and fluorinated replacements started in the early 2000s. Many new PFASs are proprietary and include functional groups that can degrade to dead-end products such as perfluoroalkyl carboxylic and sulfonic acids (PFCAs and PFSAs). To determine concentrations of unidentified PFCA and PFSA precursors, the total oxidizable precursor (TOP) assay was developed. In the process, many precursor compounds are oxidized to PFCAs and PFSAs that can be readily quantified by existing analytical methods. To date, little information is available about the fate of a recently discovered perfluoroalkyl ether acids (PFEAs) in the TOP assay. The aims of this research are to (1) determine the fate of eight perfluoroalkyl ether carboxylic acids (PFECAs), including GenX; four polyfluorinated ether acids (Nafion by-products 2, ADONA, NVHOS, HydroEVE); and one chlorofluoroalkyl ether sulfonic acid (F-53B) in the TOP assay; and (2) determine the role of hydroxyl and sulfate radicals in the TOP assay. The eight tested PFECAs and F-53B were stable in the TOP assay and thus represent new dead-end products that need to be added to the list of target analytes for the TOP assay. In contrast, the polyfluorinated ether acids were oxidized during the TOP assay. To assess whether sulfate radicals play an important role in the TOP assay, we are comparing TOP assay results (hydroxyl plus some sulfate radicals) to results obtained with UV/H_2O_2 oxidation (hydroxyl radicals only). The results of this study are expected to provide an enhanced TOP assay that will capture a larger fraction of oxidizable precursors that may be present in environmental samples.

Matt Zimmer
Graduate Program: Nuclear Engineering
Advisor: Igor A. Bolotnov
Poster Number: 212

Exploring Vertical Two-phase Flow Regime Transition Mechanisms Using High Resolution Virtual Experiments

Recent advancements in computing power allow for state-of-the-art Direct Numerical Simulations (DNS), coupled with interface tracking techniques, of fully resolved complex two-phase flows, such as flow regime transitions. These virtual experiments produce numerical data with highly resolved spatial and temporal flow information that can be studied to advance our understanding of the phenomenon and inform coarser models. With these improved models better predictions of flow regimes in Boiling Water Reactors (BWR) can be made, which strongly relate to two-phase flow heat transfer characteristics. In this work the PHASTA code, which utilizes the level set method for interface tracking, was used to examine the causal mechanisms of vertical flow regime transitions, specifically the slug-to-churn turbulent transition. The DNS was validated using theoretical and experimental work found in open literature. Different geometries, including pipes, minichannels, and BWR subchannels, were explored in order to improve the fundamental understanding of the complex flow phenomenon. Using advanced analysis techniques the transient flow properties were analyzed at resolutions not available to other methods. The numerical data analysis allows for calculation of both time and spatially averaged properties as well as local instantaneous properties. Possible mechanisms for the transition are discussed. Examples include liquid kinetic energy/surface tension force balance and limiting maximum flow rates and interfacial shear forces in the liquid film. It is also noted that the slug-to-churn transition can take at least two pathways; interfacial wave-induced instability development in the Taylor bubble leading to its disintegration or strong bubble shearing at the tail of the bubble.

College of Humanities and Social Sciences

Peter Andrews
Graduate Program: English
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Poster Number: 8

Comfortably White or Uncomfortably Black: The Racialization of Black Students in Undergraduate Classrooms

With undergraduate classrooms in historically white universities composed predominantly of white students, Black undergraduates are forced to either align with or diverge from the linguistic expectations of their non-Black peers. Previous research has established that formal education promotes discriminatory raciolinguistic ideologies that conflate Black bodies with non-standard or even sub-standard speech (Flores & Rosa 2015). Using discourse analysis in conjunction with chronotope (Bakhtin 1981) and racialization (Silverstein 2005), this study explains how institutional power structures manifest through low participation among Black students, further demonstrating that this behavior is perceived differently by white and Black professors. Fourteen participants were selected from a corpus of 57 semi-structured sociolinguistic faculty interviews ranging from twenty to sixty minutes conducted at a large southern university (Dunstan, Wolfram, Myrick and Yaeger 2018). The participants (7 Black professors, 7 white professors) taught in a variety of fields, from humanities to the natural sciences. The interview included questions about perceptions of minority student speech and participation in the classroom, as well as questions about the professors' own experiences, both as a student and as a faculty member, with respect to language. Upon analysis, two conflicting chronotopes emerge, the 'comfortably white classroom' and the 'uncomfortably Black classroom.' These two space-time-ideology configurations interact to control and suppress Black students' linguistic agency and, by extension, their ability to perform identity work. This study contributes to a more thorough understanding not only of how professor race plays a role in the perception of student behavior in the undergraduate classroom, but also of the underlying ideologies that shape the classroom space and restrict the speech of Black students. Using a discourse-analytic approach to the comments of the professors, the study reveals that mainstream linguistic ideology racializes Black students by making it impossible for them to speak without invoking one of these negative chronotopes.

Adam James Barnhardt
Graduate Program: English
Advisor: Erik Thomas
Poster Number: 14

Es ist Mittwoch Meine Dudes: A Sprachinsel Examination of English Borrowings in the Language of an Online German-speaking Community on Reddit

Goal of this paper is to demonstrate the applicability of a modified version of the classic Sprachinsel (language island) conceptualization to the analysis of smaller online language communities' discourse. This new conceptualization is referred to as the Internetsprachinsel, and denotes any language community floating in digital space where the usage of another language predominates. This contrasts with the traditional understanding of the Sprachinsel, which refers to a language community existing within a larger physical territory where a different language is predominantly spoken. To demonstrate the validity of this model, the discourse of the German-speaking Reddit community /r/de—imagined as an Internetsprachinsel "surrounded" by the larger online language community of English—is examined, specifically instances of newly-adopted English borrowings. A comparison between /r/de and traditional Sprachinseln, such as Texas German, is conducted, and various similarities in lexical borrowing and members' extra-community linguistic engagement are found. Although some possible complications are discussed in universally applying the Internetsprachinsel model, it is shown to be a potentially valid lens through which scholars can view the borrowing practices of some online language communities.

Tharaa Bayazid
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Adriana de Souza e Silva
Poster Number: 16

Community Cryptocurrency: A Twenty-first Century Take on Karl Marx

In the age of cryptocurrency, one wonders how this technology can benefit our society. Karl Marx in Capital I talks about modes/means of production, social classes, and money and how they can contribute to unjust accumulation of wealth in capitalist systems and creating social discrepancies. Moreover, he emphasizes on the role of the communist society and automation in freeing the individual from totalitarian regimes. My research is a modern take on Marx's theories in the age of cryptocurrency. I argue that community combined with cryptocurrency can create a balanced community and an enhanced capitalist system through the creation of a community cryptocurrency. By combining community and cryptocurrency into a system, individuals can generate cryptocurrency and regulate and organize the financial and economic exchanges and the labor produced in that community while competing equally, e.g., Faircoin. As a complement to the current capitalist system, community cryptocurrency not only will allow for money generation, regulation, and organization (e.g. perform two of the functions of money, that is, medium of exchange and unit of account: fungibility, divisibility, and countability, Money and the Mechanism of Exchange), but also it can minimize or prevent unnecessary wealth accumulation, or the third function of money (store of value) that usually results in socioeconomic class struggle. This argument will be achieved through a mix method of critical studies/analysis and ethnographic (participant observation) and autoethnographic field research. Creating a community cryptocurrency while considering Marx's deep thinking and analysis of the modes of production, money, and social classes can result in helping the community members, usually restricted financially, to sell and buy their goods and services not only to obtain necessary needs and wants, but also to utilize an existing skill, to re-skill, or to learn a new skill in order to meet the market demands within the community. In this way, a community cryptocurrency serves as a nexus and the means for connecting unmet needs with untapped resources and skills. Consequently, this system of community cryptocurrency will encourage local initiatives and interaction and will help build stronger community relationships, thereby increasing a sense of belonging and building social capital.

Jesse Bennett, Tonya Combs, and Perry Fountain
Graduate Program: Social Work
Advisor: Kim Stansbury
Poster Number: 17

A Process Evaluation of North Carolina Harm Reduction Coalition Syringe Exchange Programs

Syringe exchange programs (SEPs) have been widely documented over the past three decades as an effective and economical approach to controlling human immunodeficiency virus (HIV). As of July 1st, 2016, these programs have been legalized in North Carolina. We perform a process evaluation of North Carolina Harm Reduction's (NCHRC) syringe exchange program to determine the effectiveness of the program within North Carolina communities both urban and rural. Via the process evaluation, we aspire to identify which aspects of the syringe exchange program participants find to be supportive and which aspects are most challenging. Through the engagement of North Carolina Harm Reduction's established participants, we sought to pinpoint specific strengths and weaknesses which will allow for an exploration of themes that emerge over numerous counties statewide. Through the process evaluation, in conjunction with participants' input, we were able to identify needed improvements to the program as well as features that participants would like to see incorporated for the future. Positive themes emerged such as ease of access to supplies, education on treatment services, linkage to care, and appreciation for non-judgmental staff and the value of discretion. Negative themes include barriers to access due to transportation, need for later hours of operation, and lack of funding for treatment. Results and recommendations were provided to the SEP for further evaluation, including more flexible hours of operation, mobile delivery for participants in rural areas, and a concentrated effort to increase awareness of other programs offered.

Phillip Bryant
Graduate Program: Film Studies
Advisor: Andrew Johnston
Poster Number: 23

The Conspiratorial Mode of Production—Fully Exposed: Analyzing the Sandy Hook Hoax Video and the Relation to Mainstream Moving Image Aesthetics

Current American political discourse is fraught and complex, and some of its most prolific actors of paranoia are the many online conspiracy theorists who create amateur investigative videos exposing the conspiracy of whichever event might take precedence in the news; the more tragic, the more fertile ground the event is for conspiracy. Although these videos are some of the most potentially toxic forms of online media, academic study of their properties and effects are sparse. This project analyzes one such widespread video, about the 2012 Sandy Hook Elementary School shooting, and finds connections between this video and mainstream nonfiction film aesthetics. This project uses a formalist cinematic methodology, with attention paid to both political history of the paranoid and discursive methods of epistemology. Using Richard Hofstadter's writing of the "paranoid style," Robyn Marasco's complication of this rhetorical style, and Guy Debord's language of the spectacle as existing "everywhere," it is possible to extend a nature of the spectacle to online conspiracy theory videos, particularly their aesthetics of paranoia, which are influenced by the formal properties of mainstream narrative and documentary filmmaking and their platform's ability to take precedence on the "economies of attention" described by Jonathan Beller. Although digital media modalities in the paranoid style vary in online political discourse, the most insidious of these may be conspiratorial videos, because their hybrid-documentary and digital media forms allow them to tap into viewer's attentive and aesthetic pleasures, making them especially dangerous for modern political truth ascriptions. My conclusion suggests that these conspiracy videos are disseminated and initially believed not because of their internal plausibility, but because of their closeness to the aesthetics of mainstream paranoid-style filmmaking.

Tobias Cam Cannady
Graduate Program: Technical Communication
Advisor: Huiling Ding
Poster Number: 27

Visual Rhetoric Foundations in Technical Communication

While still a young field, visual rhetoric has built foundational knowledge for the power and persuasion of images in the domains of graphic design, marketing and advertising. Additionally, it has provided a substantial role in the web-based interactions of the global community. For this reason, visual rhetoric holds a significant role in technical communication because visualization is a method of information sharing and acts as a persuasive methodology to influence individuals. However, since the field is maturing, there is an opportunity to investigate how visual rhetoric influences individuals and methods of implementation in technical communication. This literature review identifies the role of visual rhetoric in a perspective evaluation by individuals and as a rhetorical device used in marketing, typology, and web-based design media. The results from this literature review identify theories of visual rhetoric and define a model for how individuals evaluate rhetorical purpose in visual elements such as typology, design, metaphorical imagery, and pedagogical practices.

Katie Cavanaugh
Graduate Program: Foreign Languages and Literatures
Advisor: Jim Michnowicz
Poster Number: 29

Perceptions of English Loan Words in North Carolina Spanish

As communities diversify and become increasingly multilingual, contact between languages causes various manifestations of language mixing, such as borrowing, calquing, and code-switching (Pfaff, 1979). The use of English loan words in varieties of Spanish is not a new phenomenon, but one that occurs with increasing frequency here in North Carolina, where the Spanish-speaking population is rapidly growing (Tippett, 2017). Language mixing tends to elicit mixed reactions among Spanish speakers themselves, many of whom reject the use of loan words even when they use them themselves, and others who like see the English influence as a form of prestige (Lanza & Woldemariam, 2013). The study of language attitudes "provide[s] valuable insight into language contact phenomena, including language maintenance of Spanish, language shift toward English, language loyalty, and ethnic and social identity issues inextricably linked to linguistic choice" (Galindo, 1995). The current study aims to evaluate attitudes of the use of loan words through a matched-guise experiment. Specifically, we ask whether hearing different speakers use or not use loan words causes listeners to automatically judge them in certain ways, e.g., more or less friendly, more or less American, more or less confident, etc. Participants will complete an online survey in which they are exposed to four different speakers (two men and two women). The speakers will read sentences in which loan word are discretely placed. Participants will then rate the speakers after listening to each audio sample. Based on historical trends, we hypothesize that participants will rate more negatively the speakers that utilize loan words in their speech, as "Spanglish" tends to be highly stigmatized (Pfaff, 1979). As the linguistic landscape of our society becomes increasingly diverse, it will be interesting to see if this stigmatization tendency continues in the Spanish of North Carolina.
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Jianfen Chen
Graduate Program: Technical Communication
Advisors: Agnes Bolonyai and Huiling Ding
Poster Number: 31

Detecting National Ideologies in News Reports on US and China Trade War

In 2018, the US and China trade war has escalated with US's threats of imposing new tariffs of $267 billion covering almost all imports from China, China's cancelation of trade talk with the US in September, and the US' accusation of China for election meddling in October, before the two sides agreed on a 90-day suspension period in proposed tariff increases on Dec 1, 2018. This trade war has drawn coverages from news media in the US, China, Hong Kong, the UK and many more. However, scant research has been done to examine the power and ideology that are in play in these news coverages. Drawing on the ideological discourse analysis framework proposed by Van Dijk (2006), this study examines 57 news reports on this trade war collected from Nexis Uni database. These news reports were selected with "US and China trade war" as the keywords to ensure the content relevancy and to uncover the national ideologies of the two countries as the hidden force that drives the ostensible and discursive discourse forms, meanings, and interactions in these reports. Published by *The Washington Post* and *China Daily* respectively, these reports cover the trade war period from October 2017 to January 2019. The discourse analytical apparatuses of othering, stance and style, indexicality, and metaphor are employed to identify and describe the ideological differences represented by these news reports. The findings and analysis of the study suggest that the superficial language variations in these news reports are rooted in and caused by differences in national ideologies which are traceable and identifiable with the assistance of critical discourse analysis tools: US news reports reveal its national ideology of positive self-representation and protectionism; Chinese news reports when constructing its positive-self representation ideology similar to the US's are conveying the ideology of cooperativism and inclusivism.

Sarah E. Edwards
Graduate Program: Anthropology
Advisor: Shea McManus
Poster Number: 48

The Politics of Place: Branding, Identity, and Belonging in Pinehurst, NC

Constructions of place are never neutral. Indeed, places are culturally constructed and these constructions are fiercely contested, controlled, and protected as markers of identity. This research examines how boundaries of identity and belonging are constructed through the phenomenon of place branding in Pinehurst, North Carolina. Drawing from 25 semi-structured, formal interviews and participant observation with residents and local destination marketing employees, this research contributes to an ethnographic and locally situated understanding of place branding. Pinehurst's place brand mobilizes symbolic resources, including elements like golf, tartan, and nostalgia, to construct a cultural space and a social imaginary through which residents view the world and organize themselves within it. This discursive construction of place is appropriated and maintained by residents, who seek to reproduce and maintain this imaginary through discourses of historic and aesthetic preservation. These discourses of preservation generate specific raced and classed ideologies of identity and belonging and are mobilized in response to the increasing growth and development occurring in the area. Residents and destination marketing officials draw from a global imaginary of Scottish heritage, as well as nostalgic ideals of small-town American life, to assert the historical whiteness of the area. In addition, the place brand also draws on tropes of luxury, leisure, and exclusivity in an effort to appeal to certain kinds of potential visitors and residents, and to maintain its own status. Ultimately, my findings demonstrate the ways in which the place brand is used to create exclusions at the same time that it generates feelings of identity and belonging. As such, this research can be understood in relation to broader contemporary national debates about space, place, identity, and belonging.

Nicholas Eng
Graduate Program: Communication
Advisors: Elizabeth A. Craigand and David M. Berube
Poster Number: 49

Attracting Young Talent into the Workforce: Does Framing Corporate Social Responsibility in Job Ads Still Work?

Due to the urgency of climate change action, there is a need for relevant stakeholders such as industry and individuals to engage in sustainable development. Corporate Social Responsibility (CSR) acts as the common ground for these two groups. It has often been used as a tool to attract young job seekers since factors like salary have limited variability. This is unsurprising considering that organizations want to stand out from the competition in an oversaturated job market by appealing to the values of job seekers' who are increasingly looking for meaning and satisfaction in their careers. Previous research has shown that companies that engage in pro-environmental CSR tend to be more attractive to potential job applicants. However, limited research has been conducted on how pro-environmental CSR communication is framed to maximize talent recruitment. This experiment evaluates the effectiveness of differing levels of pro-environmental messaging in attracting first-time job seekers to join an organization. Participants consisted of 315 millennial job seekers at a large university in the southern US. The data was analyzed using one-way ANOVA, ANCOVA, and independent samples *t*-test. There were no significant differences between the different job ads and job seekers' attraction and willingness to join an organization. However, significant differences were found when comparing just between job ads with general pro-environmental messaging and job ads without. At the same time, the job ad with specific pro-environmental messaging had consistently lower scores compared to the ad with general pro-environmental messaging. Findings suggest that millennial job seekers are still attracted to pro-environmental messages but might have heightened skepticism towards organizations that overplay their environmental contributions. This study highlights the importance of framing pro-environmental messaging that can be applied to overall climate change communication to ensure the desired attitudinal or behavioral change.

Amanda E. Finn
Graduate Program: Public History
Advisors: Tammy Gordon and Craig Friend
Poster Number: 54

Land, Legacy, and Language: Bridging the Public History Gap through Family History

Family histories are often conducted by enthusiasts who do not adhere to the methods of academic historians. Often, genealogical studies reinforce the oral traditions of their researchers who spend enormous amounts of time and resources to fill out a family tree. As proven by the popularity of genealogy websites like Ancestry.com and TV series like *Who Do You Think You Are?*, tapping into the enthusiasm for family history offers an opportunity for public historians to connect with a large audience base and tell previously silenced narratives. By filling this gap between popular and academic history, public historians can answer the call for family histories while demonstrating the academic research techniques necessary to maintain professional historic standards. Investing in, rather than disparaging the pursuit of, family history is critical to acquiring public investment in historical practice. The objective of this work is to provide a family history case study that can be used as a model for both academic historians and genealogists, bringing the efforts of genealogists to a broader public. Tracing a western North Carolina family through three generations using primary data, I model how public historians can contextualize genealogies with secondary scholarship in a way that bridges the gap between genealogy and academic history. Microhistories, like this case study, puts names to early backcountry settlers around the time of the American Revolution, provides insight into the lives of rural farmers in the decades after the Civil War, and assigns faces to the first industry workers who supplied power and communication to rural areas in North Carolina. This model answers the call of genealogists by moving past the generalizations of national narratives and using subjects who humanize large movements in human history, while using professional historical methods that satisfy academic rigor.

Maria Cecilia Gines
Graduate Program: International Studies
Advisor: Lada Kochtcheeva
Poster Number: 61

The Success of Urban and Peri-urban Agriculture Programs in Latin-American Cities: The Case of Rosario, Argentina

The phenomenon of urban and peri-urban agriculture (UPA), which involves growing and producing food from plants and animals within and around urban areas, has become increasingly popular in cities across all continents since the 1990's and is practiced by over 800 million people worldwide, according to the Food and Agriculture Organization (FAO). These initiatives contribute to food security, poverty alleviation, and resilience in urban areas, and they represent one path (among others) to face the challenges posed by increasing rates of population growth as well as greater segments of the population living in cities, and the consequent rising demand for food. Both trends are most prominently observed in developing countries, which is why studying this phenomenon is so relevant. This research aims to answer the following question: what explains the success of UPA programs? It argues that local governmental support, cooperation with research and non-governmental organizations, and motivations of individuals are all contributing factors. Following a qualitative case study methodology to analyze an urban agriculture program implemented in the city of Rosario, Santa Fe (Argentina), this study found that political will, enabling policies, and a legal framework within the municipality were crucial for the institutionalization and sustainability of the program. Moreover, multi-actor cooperation ensured access to training and inputs for urban farming. Lastly, the presence of strong incentives for citizens to engage in urban agriculture provided the essential social component for the program to be created and to progress. What started as a short-term initiative to assist sectors of the population in need, evolved into a permanently established activity that generates benefits for society as a whole and that can serve as a model to be replicated in other cities of the country and the region.

Ragan L. Glover
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Adriana de Souza e Silva
Poster Number: 62

Content Delivery Networks (CDN): Understanding Infrastructures as Experience

In 1993, the Internet became more accessible to the general public through the Mosaic web browser and, consequently, the Internet's users and content grew substantially. This growth resulted in slower loading times for Internet content and users' frustrations with Quality of Experience (Stocker et al., 2017). In 1998, the corporation Akamai responded by developing a commercial service, known as the Content Delivery Network (CDN). The CDN created a geographically distributed network of servers to quickly deliver cached Internet content to users. Akamai developed the CDN in recognition that the speed for delivering Internet content increases when content is physically closer to the user. While the CDN may appear obsolete, given the current cloud computing paradigm which centrally stores Internet content, the CDN merits attention given that it (1) persists as a legacy system working in conjunction with the cloud to quickly deliver content, and (2) the CDN is currently informing solutions to ubiquitous computing's demand for real-time responsivity. As such, I historically examine the CDN toward answering how the CDN produces a sense of immediacy for users and how the CDN shapes understandings of Internet history. In doing so, I apply a media archaeology approach to examine the technical operations of the CDN and the cultural moment in which the CDN was developed. I argue that the CDN produces a sense of immediacy by obscuring its operations to give the illusion that the Internet creates instantaneous communication, regardless of time and space. Additionally, I argue that, contrary to narratives which suggest that Internet speeds increase with time, the CDN reveals that Internet history is characterized by general slowdowns as users and content increase. Together, these arguments suggest that the infrastructures of the Internet are important to understanding the experiences the Internet produces.

James B. Harr III
Graduate Program: Communication, Rhetoric, and Digital Media
Advisor: Timothy Stinson
Poster Number: 72

Remodeling the Narrative: Communication Networks, Petitionary Texts, and the 13th Century Prosopography

Studies that apply Social Network Analysis (SNA) to historical documents and literary texts are becoming more reflective of the innovations and developments in digital medieval studies. Historical SNA studies conducted by Hammond (2016) looks at family trees in medieval Scotland to create a network. Similarly, Geggel (2018), builds a literary network using Irish and Viking texts, demonstrating a shift in medieval studies as they converge with network theory. However, none of these studies focus on historical documents or their contributions to paleography. In this project I employ SNA to examine the reign of Edward I (1272-1307), both in terms his place in English history and his impact on historical communication networks. Using petitions as historical evidence, I analyze smaller conversations occurring in England, looking at whether these events did, in fact, impact life in Western Europe. The data extracted from these minor historical documents are used to construct visualizations representing prosopographies - or collective narratives - shaped by English communication networks. The source material for my current research begins with a sample of 413 open-source digitized documents available from the British National Archives' Special Collection 8. I argue that this methodology can give historians a better sense of the past. The results of this study reveal trends in 13th century communication networks, but, more importantly, provide the framework for a working model that future research in historical Social Network Analysis can implement.

Nupoor Jalindre
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Poster Number: 83

Blockchain for User Forums

The introduction of blockchain is resulting in a shift from highly centralized, single-point-of- failure systems to those that are closer to being user-controlled in networks, engaged in creating value. User forums are becoming extremely popular due to their ability to provide individualized help information for specific user problems. However, their structure poses a challenge for preserving quality of content and quality of social interactions. This research is a speculative study about the potential uses of blockchain to overcome these challenges. Blockchain adds a new dimension to the process of knowledge creation between strangers in the absence of trusted relationships. The research first investigates the problems of user forums caused by design constraints. Next, it attempts to explore these constraints using Actor Network Theory. Further, it speculates the functioning of user forums based on analogies of collaborative writing and blockchain technology. Finally, it discusses the shift from 'users' to 'content' brought about by the proposed framework.

Stephanie Jean Jares
Graduate Program: Liberal Studies
Advisors: Jessica Jameson, Michelle Bartlett, Karey Harwood, and Barry Olson
Poster Number: 84

The Impact of the Potential Dissolution of DACA on Higher Education and DACA Qualified College Students

The potential dissolution of DACA (Deferred Action for Childhood Arrivals) by the Trump Administration could have a large negative impact on higher education institutions who will have to choose between whether to follow the policies of the federal government or protect Dreamer students. If DACA is dissolved by the Trump administration there will be a tremendous negative impact on Dreamers who are college students because their college education will be in jeopardy due to the fact they will no longer have legal status in the United States. If DACA is dissolved then College Presidents and Chancellors will have to choose whether to violate the law by placing the rights of their Dreamer students first or follow the law and place the federal government regulations and Executive orders first. While the future of an estimated 800,000 Dreamers remains in the balance, college officials debate over whether they should implement policies to aid Dreamer students. The majority of colleges in the United States have not announced whether they will support Dreamers or the federal government in the event that DACA is dissolved. The purpose of my study is to analyze the impact of the potential dissolution of DACA by the Trump Administration on higher education in the United States and Dreamer college students who have qualified for DACA. My research methods consisted of an examination of how college institutions are responding to the potential dissolution of DACA, a summary of the impact of the potential dissolution of DACA for Dreamers and institutions of higher education and the implications of the responses from higher education Administrators. Based on my research I recommend that higher education institutions act as student advocates and provide resources and information for Dreamers in order to support their students without having the higher education institution break the law.

Christine R. Johnson
Graduate Program: History
Advisor: Katherine Mellen Charron
Poster Number: 88

The Civil Rights Movement as Seen Through Textbooks

Through commemorating Martin Luther King Jr. with a federal holiday and celebrating civil rights activists during Black History Month, Americans proclaim that the Civil Rights Movement (CRM) holds an important place in the nation's identity as an example of progress and the success of American democracy. Despite the acclaim granted to the CRM in recent American history, the narrative found in this study of high school and survey-level college published from 1963 to 2003 reveals that the more recent treatment of the CRM has more in common with past interpretations than imagined. The textbook story of the CRM remains incredibly positive about the movement's achievements, while still ignoring its longer history, and the hard work done by ordinary men and women. My examination found that the federal government remains a main heroic actor of the CRM, even when additional African American leaders populate newer studies. Textbooks' effusive praise of King also suggests that an appropriate way to conduct activism exists, and they continue to designate Malcolm X and Black Power as inappropriate foils. Textbook portrayals should not just add more material as token acts of accommodation, but substantially change the composition of the story they tell to include the wider, and more complicated, story of the black freedom struggle in the civil rights era. The simplistic version of history that textbooks convey of the CRM does a grave injustice to our collective history, to the movement's participants, and to current and future generations.

William Christopher Laws
Graduate Program: Public History
Advisor: Craig Thompson Friend
Poster Number: 107

The Political Implications of Releasing Water from a Dam: A Case Study about Hurricane Fran, Falls Lake Dam, the Neuse River and the US Army Corps of Engineers

The US Army Corps of Engineers (USACE), first founded in 1775 to design and build defense fortifications against the British during the American Revolution, has a history of involvement with various projects aimed at economic development. However, USACE has long maintained that they are an apolitical organization, and that their decision-making is solely based upon scientific data. This study analyzes USACE's decision to release water from the Falls Lake Dam in 1996 in the aftermath of Hurricane Fran. Fran's rains filled the Falls Lake Dam reservoir to the point where another inch and a half of rain would have caused the lake to overflow, and possibly inundate Raleigh and its water supply with contaminated water, or worse, cause a catastrophic dam failure. Further complicating the situation, another tropical system was heading towards the US mainland and threatened to bring more precipitation to North Carolina. Based on the information they had at the time, USACE released water from the dam into the Neuse River. The resulting water ended up flooding several communities downstream, destroying approximately 3,000 homes. By analyzing USACE water control manuals from the period and looking at US Census data, the evidence in this study reveals that while USACE followed established procedures in determining whether or not to release water from the dam, their actions had significant political implications as the communities affected by the flooding were socioeconomically disadvantaged compared to Raleigh, which was spared by the Corps' actions. This case also revealed deficiencies in USACE's policies regarding engaging with communities as stakeholders, and including them in policy-making decisions. Overall, the case illustrated the continuing vitality of the Corps of its self-perception as a technical, apolitical player, and the costs and difficulties of this perspective in a real-world situation.

Travis R. Merchant
Graduate Programs: English and Film Studies
Advisor: Jason Miller
Poster Number: 129

Tension Building the Dream: Montage of a Dream Deferred and Soviet Montage

Over decades of literary scholars examining Langston Hughes's work, his book of poetry *Montage of a Dream Deferred* continues to be the source of countless debates—especially in its use of montage. While scholars and Hughes highlight jazz montage as the main source of contention in the poems, the poems have a new punctuated meaning when examined through the theories of Soviet Montage. The theory of montage—laid out by Soviet filmmaker Sergei Eisenstein—emphasizes the uses of juxtaposition to create tension. Even though the Soviet theory by Eisenstein seems targeted to film, there are moments in his book Film Form in which he examines poetry as a "montage phrase" and "a shot list." Using a formalist approach, I asked the following questions: How do the five different montages—metric, rhythmic, tonal, overtonal, and intellectual—appear throughout the poems? What do these juxtapositions reveal about Hughes's lamentation about life for African-Americans? This research sheds light on Hughes's possible fascination with film, which would extend past the screenplays he wrote. Additionally, it would show how montage theory of film can apply to the selection of poems and display yet another possibility of Hughes's work beyond just a literary approach. In addition to writing a paper about the poems and images that were drawn for the book—though never printed alongside the poems—I created a short video using the images, videos of New York life in the 50s, and music I composed with the words of poetry spoken alongside. This video displays the montage of the poems using the form of film to express the heightening tension of the dream deferred that Hughes examines.

Jeremy C. Miller
Graduate Program: Foreign Languages and Literatures
Advisor: Rebecca Ronquest
Poster Number: 131

Motivation in the Acquisition of L2 Spanish Phonetic Traits

It is generally accepted that motivation is a key aspect in the acquisition of second languages as well as in the acquisition of second language sound systems (Elliot 1995; Martinsen et al. 2014; Nagle 2018). However, not all studies have been able to establish this connection very clearly (Ute 2002) and some have had conflicting results (Elliot 1995). Further, there have been criticisms of the broad treatment of motivation in previous studies and a call for analysis through specific linguistic phenomena (Ushioda 2016) to clarify earlier unclear results through the separate measurement of both intrinsic and extrinsic motivation (Amabile et al. 1994). Specifically, this study will explore the acquisition of voiced approximants [ß], [ð] and [ʔ]; unaspirated stops /p/, /t/ and /k/; syllable-final 'light' (alveolar) [l]; and the use of voiceless [s] in places where [z] would be expected in English (ie pre[z]ident vs. pre[s]idente). These are examples of phonetic traits of Spanish that differ from English,so students must acquire them as they are learning Spanish (Hualde 2014). The primary purpose of this study is to explore the relationship between student motivation and the acquisition of these sounds. Do more motivated students acquire them more successfully? What differences in acquisition exist between students whose motivation is extrinsic vs. intrinsic? Speakers, drawn from Intermediate-level (third year) Spanish classes will be presented with a word list, and recordings will be analyzed in Praat. In addition to motivation, other factors are to be considered, such as previous exposure to phonetics in a classroom, the difference between cognates and noncognates, and previous travel abroad experiences. A pilot study was performed with a sample population of four students. While detailed statistical analysis was impossible, linear regression showed a number of near-significant results that will be further explored in this study.

Marissa S. Morgan
Graduate Program: English
Advisor: Agnes Bolonyai
Poster Number: 135

Azealia Banks vs. Cardi B: The Great Debate, Evolved

This essay takes a critical discourse analytical approach to analyzing the feud between Azealia Banks and Cardi B, starting with an interview from May 2018 on "The Breakfast Club" radio show during which Azealia Banks referred to Cardi B as a "caricature of a black woman that black women themselves could never get away with." Azealia also referred to Cardi B as an "untalented, illiterate rat" and has maintained in other interviews her belief that Cardi B promotes illiteracy and has derailed conversations regarding black women's culture on the national stage. Cardi B responded by dismissing Azealia's ability to "advocate" because of her history of skin bleaching. The feud between Cardi B and Azealia is posited with relation to The Great Debate, which necessarily includes Booker T. Washington, yet for the purposes of this paper refers to disagreements between W.E.B. DuBois and Marcus Garvey. The feuding discourse between W.E.B. DuBois and Marcus Garvey is taken from stories printed in their respective newspapers, the Critic and The Negro World. DuBois imagined blackness and black progression as entrusting that progression in the hands of a select few, thereby rooting acceptable black presentation in intellectual enterprise. Garvey imagined blackness and progression as a desire to liberate and return to Africa; he resented DuBois' focus on the black elites and his willingness to collaborate with whites in his effort to achieve racial equality. This paper seeks to parallel the themes of colorism, intellectualism, and the notion of an "authentic" or "acceptable" black identity present in both feuds. The theoretical frameworks used include chronotopic identities as defined by Blommaert & de Fina, the stancetaking triangle as defined by Du Bois, and the linguistic marketplace as proposed by Bourdieu. This study explores the paradoxical yet persistent obsession with answering the question, who gets to define blackness? and how this question has evolved from the early 1900s to 2018.

Erik Myxter-lino
Graduate Program: International Studies
Advisor: Mark Nance
Poster Number: 136

Geo-Politics or Profit? The Domestic Determinants of Overseas Investments by Chinese State-owned Enterprises Within the Belt and Road Initiative: A Case Study of HuaDong Engineering Corporation

Since the beginning of China's 'Going Out' strategy at the turn of the century, Chinese State-Owned Enterprises (SOE) have become major international players in building energy and infrastructure projects throughout the developing world. In 2013, China's President Xi Jinping, unveiled the $1 trillion Belt and Road Initiative (BRI) that strengthened the commitment of Chinese SOEs in building infrastructure throughout Eurasia, Africa and beyond. At the same time domestically, through the anti-corruption campaign, Xi has consolidated power more than any Chinese leader since Mao and has entwined himself with the BRI personally, highlighting the importance of the initiative to Chinese foreign policy. Some scholars frame the BRI as an extension of the Chinese state's newfound power, where Beijing is using its State money and SOEs to shift regional or potentially global geopolitical gravity (Rolland 2017) or even as a deliberate means to place smaller countries into debt-traps to gain geo-strategic assets (Smith 2018). Liou's (2014) pre-BRI neo-institutional analysis of the determinants of Chinese SOE's transnationalization, found that although SOEs are state-run, they are not state-dominated and that the actors within the firm, used their relationships within a fragmented bureaucracy to gain as much corporate revenue as possible. This study aims to further Liou's (2014) work by conducting a neo-institutionalist case study of another major Chinese SOE the Huadong Engineering Corporation in the post-BRI world to answer the question: Within the Belt and Road Initiative, what are the determinants of Chinese SOE overseas investments?

Bhoopali K. Nandurkar
Graduate Program: Communication
Advisor: William J Kinsella
Poster Number: 95

Communication and Information Technology Uses in an Indian Software Development Setting

The existing studies about the uses of Information and Communication Technologies (ICTs) in organizations are mainly focused on efficiency, productivity, managerial decision-making, and causal relationships between variables. Additionally, most studies based on the Indian corporate scenario are quantitative analyses, with limited attention to ethnographic studies. This research contributes to the conversation pioneered by Gideon Kunda in his 1992 ethnographic study of a high-tech corporation. Using a critical/interpretive approach, inspired by Kunda, this study adds a unique dimension by investigating the underlying meanings, values, practices, rituals, attitudes, and narratives surrounding communication technologies and how they contribute to the power dynamics and employee relationships in an Indian software organization. This ethnographic study employed a qualitative methodology. Total 24 semi-structured interviews were conducted in three languages: English, Hindi, and Marathi, based on the participants' preferences. About 300 single-spaced pages of transcribed data was produced based on the interviews and the field observations. A combination of theoretical frameworks and open coding approach was used to analyze the data. Concepts including organizational discipline, institutionalization, control, identity regulation, and power were used to examine the organizational processes mediated by communication technologies. Five technologies were identified as primary communication channels in this organization: handwritten-notebooks, email, Jira (a project-tracking tool), conference calls, and instant messenger. The first round of analysis revealed interesting practices and motivations surrounding the uses of a seemingly antiquated communication tool, handwritten notebooks. These company-issued notebooks are valued as intellectual property of the firm and are extensively used for note-taking, recording agendas, instructions, conversations, and for maintaining evidence. Additionally, monetary rewards are offered for best-kept notebooks. Preliminary analysis showed how the notebooks served as instruments for inducing organizational discipline and order. Further research examined how technologies like email and instant messengers functioned as mechanisms for inflicting self-discipline and surveillance in the workplace.

Leanne Nieforth
Graduate Program: Communication
Advisor: Elizabeth Craig
Poster Number: 138

A Proposed Process Behind the Breakthrough Moments in Equine Assisted Mental Health Sessions

Experiencing trauma can lead to a variety of chronic and acute symptoms including post traumatic stress disorder (PTSD), anxiety, depression, substance abuse, poor academic achievement and poor social skills. Given the variety of causes for trauma and the individualized subjective interpretation the trauma entails, treatment is difficult and incorporating effective alternative treatment options is important.Equine assisted mental health (EAMH), a team approach incorporating horses, clients, mental health professionals, and equine specialists, has been successful in treating those who have experienced trauma including, but not limited to, veterans and individuals with PTSD, at-risk youth, court involved youth, victims of sexual violence, and children who have been neglected. However, there are many different modalities, or practice styles, of EAMH across the United States and internationally. The viewpoints of these organizations with respect to the role of the horse and human differ by practice style, making it difficult to identify how and when the therapeutic breakthroughs occur consistently within the industry. The current study includes 19 semi-structured interviews with professionals (equine specialists or mental health professionals) who currently practice at least one of four different modalities of EAMH (EAGALA, TF-EAP, OK CORRAL or Eponaquest). Preliminary qualitative analysis suggests that breakthrough moments in therapy for those who have experienced trauma are facilitated by nonverbal turning points communicated from horses which prompt communicated perspective taking among the client and treatment team. Implications for human-horse communication and trauma-informed care utilizing EAMH are discussed.

Marissa Personette
Graduate Program: Sociology
Advisor: Stacy De Coster
Poster Number: 148

Who Steps In?: Bystander Intervention in Cases of Sexual Assault on College Campuses

This study spotlights bystanders as an important tool for understanding and preventing sexual victimization on college campuses by wedding social psychological literature on bystander behavior, sociological research on rape myths, and multidisciplinary research on violence against women. Using a vignette survey distributed to 1011 college students, this research contributes to the growing field of literature examining the decision-making process of bystanders choosing or failing to intervene in cases of sexual violence on college campuses. In order to fill important gaps in existing literature that fails to adequately understand how relational, situational, and demographic variables intersect with attitudes towards sexual violence to predict prosocial bystander, I content the following hypothesis. First, female bystanders will report a greater likelihood of intervention than male bystanders; second, the relationship between the bystander and the actors involved in sexual violence will influence the rates of prosocial intervention; third, bystanders with lower rates of rape myth acceptance in high-severity situations will have higher rates of prosocial bystander intervention; and fourth, non-white bystanders will intervene at greater rates than white bystander. Using data collected at a large four-year university in the southeastern U.S., I find support for the first three hypotheses, while the race-based hypothesis has mixed findings. I argue that these findings mean bystander education programs must utilize gender-targeted programming that combine information on relationships with actors, attitudes towards sexual violence, and less apparent emergent situations in order to more efficiently increase rates of prosocial bystander intervention on college campuses.

Mary Byrd E. Pettenati, Anna N. Christopher, Negin G. Kempf, and Sara S. Monazah
Graduate Program: Social Work
Advisor: David C. Fitzpatrick
Poster Number: 33

The Impact of the GLBT Center Advocate Program: Evaluation Report

People from various marginalized groups, including people of color, people with disabilities, religious minorities, and GLBT individuals, make up a significant portion of the North Carolina State University community. These groups experience many negative interactions that lead to feelings of exclusion on campus. Through social justice education workshops, the Advocate Program aims to increase the inclusion of marginalized populations on campus by helping workshop participants better understand the experiences of these groups. After each educational workshop, participants completed questionnaires that evaluated learning outcomes. These questionnaires included Likert scale questions and open-ended short answer questions examining participants' understanding of the workshop topic. Statistical analysis, including ANOVAs with Tukey's post hoc, was performed to assess and compare the effectiveness of the workshops. Through an iterative process, we used an integrated qualitative coding approach to discover learning themes from participant short-answer responses. Results indicate that certain workshops were more successful in increasing knowledge about the workshop topic whereas other workshops could benefit from curriculum reevaluation. Of the 28 workshops evaluated, "Promoting Service Without Evoking the White Savior Complex" was the least effective. Some of the most effective workshops included "Shifting Our Framework for Supporting Students with Disabilities in the Classroom," "Recognizing and Responding to Microaggressions," and "Interpersonal Violence and Sexual Violence in the GLBT Community." We used Cronbach's alpha to assess the reliability of the questionnaires. Only six of 28 questionnaires had an alpha of less than 0.80, meaning 22 questionnaires were reliable for continued use. Though most of the workshops had positive results for learning outcomes, we recommended reevaluating some questionnaires, workshop topics, and educational approaches. Additionally, we suggested that the program incorporate peer and academic mentorship and perspective-taking exercises to increase understanding of marginalized groups on campus.

Kristin Robinett
Graduate Program: Technical Communication
Advisor: Huiling Ding
Poster Number: 157

Hypotheses and Hyperlinks, Test Tubes and Twitter: Communicating Science to the Public in the Age of New Media

As scientific topics become more complex and politically charged, effective communication of science is more important than ever. Efforts have been made in the past several decades to move from a one-way model of scientific communication to a two-way or multi-way model, in which experts and non-experts interact, and non-experts contribute to the co-production of scientific knowledge. New media – means of mass communication using digital technologies such as the Internet – seem well suited for the practice of a two-way model of science communication, but research in this area is in its early stages. This project examines how new media are changing the way science is communicated to the public. Twenty recent peer-reviewed journal articles were reviewed and annotated to produce a literature review on the topic of science communication and new media. The literature shows that new media environments allow the public to access scientific information more easily and enable scientists to communicate directly with the public. However, although new media have the potential to provide spaces for inclusive public discussion of science issues, science communicators often underutilize new media's capacity to enable two-way participatory communication. Additionally, the use of new media is raising new challenges in science communication, such as the spread of misinformation and the potential for uncivil language to impede healthy public discussion. These findings highlight the need for further research into the changing relationships among science, media, and the public, and the continued need for science communicators to guide the complex process of two-way public science communication. Science communicators should stay updated on emerging research to learn how to best create online communication spaces that encourage public engagement with science, welcome the contributions of non-experts, and minimize the spread of inaccurate information.

Timothy P. Rose
Graduate Program: Liberal Studies
Advisor: Seth Murray
Poster Number: 176

Addressing Challenges Related to Cultural Adaption in Saudi Arabian Students Enrolled at NC State University

Academic research shows that international students, in general, and Saudi students in particular, face cultural challenges that, if not overcome, may lead to anxiety, depression and, in extreme cases, academic failure. In response, this research project has three main objectives. The first is to explore the challenges Saudi students may face as they adapt to life at NC State. The second is to catalogue the different support services the university currently has set up which could help in the cultural, social and academic adaption of the Saudi student population. The third is to make suggestions that NC State could easily and cost effectively implement to increase the overall success of Saudi Students. Over the last two decades, NC State University has followed national trends by actively recruiting more international students. Up from 4.5% in 1998, the international student population at NC State is now 11.8% of the overall student body. Saudi Arabian student enrollment, both nationally and at NC State, has also increased during this time. There are currently over 44,000 Saudi students studying in the US, making them the 4th largest international student group. As of spring 2018, NC State's 70 enrolled Saudi students were the university's 5th largest international population. While NC State has set up various programs tailored to international students, in general, they have very few programs that deal with students of specific nationalities or geographic areas such as Saudi Arabia or the Arab Gulf. Suggestions include; providing all Saudi students with an advisor knowledgeable of the Arab language and culture; requiring a for-credit cultural competency/global skills class for all Saudi students; hiring an Arabic speaking counselor for the Counseling Center; providing occasional Saudi meals at the dining halls andproviding written resources and workshops for NC State faculty and staff regarding working with Saudi students.

Cynthia P. Rosenfeld
Graduate Program: Communication
Advisor: Elizabeth Craig
Poster Number: 162

Slithering Stories-We-Live-By: Animal Educators' Construction and Enactment of Positive Narratives About Snakes

Representations of snakes abound in literature—from Greek mythology to the Bible to the *Harry Potter* series—in oral traditions, and the visual arts (e.g., 2006's Snakes on a Plane), and these representations create the "stories-we-live-by" (i.e., stories that tell members of a society how they should feel about snakes). Often constructed as sneaky or sinister, the cultural evaluation of snakes can perhaps best be stated by the adage, "The only good snake is a dead snake." Although this evaluation is widespread, it is not universal. Animal educators (e.g., naturalists, docents, rehabilitators) are agents of an alternative evaluation that exists in struggle with the dominant one. To examine the messages and the process of messaging used by animal educators, I conducted a study with ethnogrpahic methods situated in the setting of animal education. Sites include a natural science museum, botanical garden, ecological park, rescue and rehabilitation locations, and small-scale education centers (e.g., traveling education programs). Animal educators promote ecological discourse and engage in a multimodal resistance of the cultural evaluation of snakes as "bad." The adoption of new stories may be resisted or accepted by the audience members, and the setting may constrain or enhance the message of the educators. To (co)create new stories-to-live-by, educators work to resolve the attract-challenge (i.e., attracting the attention of the audience and challenging the audience's existing stories) and ecology-individual tensions (i.e., promoting discourse that is ecologically-minded and represents the snake as an individual subject-of-a-life). Through their discourse, enactments, and material displays, animal educators offer a narrative with the central message, "The only good snake is a live snake."

Federico Scholcover, Yussef Guerrab, and Douglas J. Gillan
Graduate Program: Psychology
Advisor: Douglas J. Gillan
Poster Number: 165

Predicting Performance Differences in Teleoperation of Robotic Vehicles Using Time Perception

Robotic vehicles and tools extend human capabilities beyond what we could normally do and allow us to go to places that we safely could not go. We can send these robots out into space, to explore hostile environments. An advantage is that the human operator and robot don't necessarily need to be in the same area. They may be states away, continents away, or even on a different planet. This is known as teleoperation. As the distance between operator and robot increase, latency increases (Lester & Thronson, 2011) and performance plummets. Tasks take longer and more errors are made (Sheridan, 1993). However, there are individual differences in how much someone is affected by latency (Scholcover & Gillan, 2018). Therefore, identifying what cognitive abilities lead to resiliency of the effects of latency may be a useful avenue in the selection and training of future robot operators. Scholcover et al. (2018) found that differences in time perception predicted performance in a navigation task, across varying levels of latency. Their model suggested that participants over-/underestimated how far their vehicle moved by under-/overestimating the time it would take the vehicle to travel. However, the course width was static throughout the study. Recent work (Chan, Hoffman, & Ho, 2019) demonstrated that course width affected both movement time and the number of errors committed in a similar task, supporting the over-/underestimation hypothesis. This study extends the findings of Scholcover et al. (2018) and Chan et al. (2019). Participants were tasked with navigating courses of different width across different levels of latency. As in Scholcover et al. (2018), individual differences in timing were collected as well. Data analysis is currently ongoing. However, preliminary findings suggest that the relationship between timing on different performance metrics is highly dependent on both latency and course width.

Michael A. Sciacca
Graduate Program: Foreign Languages and Literatures
Advisor: Jim Michnowicz
Poster Number: 167

Do I Sound Gay… in Spanish? An English–Spanish Analysis of the /s/ Variable in Bilingual Non-heterosexual Men

While it is often difficult to find linguistic characteristics that clearly distinguish gay men from straight men, perception studies have offered insight into the characteristics that separate gay speech from heterosexual speech (Gaudio, 1994; Levon, 2006; Zwicky, 2003). In English, non-heterosexual men possess a pronunciation of the /s/ that may be more forward or dentalized (Van Borsel et al., 2009; Zwicky, 2003). As a standard pronunciation of Spanish is typically taught in Spanish classrooms in the United States, the voiceless alveolar fricative /s/ sound is not often taught as distinguishable sound between English and Spanish (Carbó Marro et al., 2003). However, research shows that non-heterosexual men often do produce /s/ sounds differently from their heterosexual counterparts in English (Van Borsel et al., 2009). As such, the current investigation will examine the fricative /s/ in voiceless contexts in both English and Spanish produced by the spontaneous speech of non-heterosexual men who are L1 English and L2 Spanish bilinguals, observing if they separate phonetic categories between languages. As the two control groups, heterosexual men and women will be studied to observe if their speech patterns differ from or follow the patterns of non-heterosexual men. Spectral center of gravity measurements will be realized in unvoiced contexts of the /s/, and statistical analyses will offer insight into the patterns of each group of participants. The goal of this study is to determine if non-heterosexual participants produce a fronted or hyperarticulated /s/ in English, and if so, is that variant of /s/ also produced in their Spanish? It is hypothesized that non-heterosexual men who are native speakers of English and second-language Spanish speakers will separate phonological categories between the two languages when producing the /s/.

Katelyn M. Smith
Graduate Program: Foreign Languages and Literatures
Advisor: Hector Jaimes
Poster Number: 161

***Texas* by Carmen Boullosa: Power, the Subaltern, and Literary Techniques**

Texas: The Great Theft (2012) takes place in 1859 in Bruneville and Matasánchez, two cities located along the border of Mexico and the United States. The novel narrates the political history of the region, an area that is ethnically diverse, which generates a tense and divided society filled with power struggles and culture clashes. The objective of my project is to examine the literary techniques utilized by Carmen Boullosa in order to further question the social structure represented through the characters' narrative voices; this questioning is carried out through the use of testimonies that revolve around one significant event from the perspective of socially excluded characters. I apply subaltern and ethnic theories to analyze how Boullosa creates a series of critiques about the social inequality that existed during this time period. I also identify subaltern voices, which appear through a narrative discourse that draws awareness to actors who have been omitted from the official history because they were considered secondary. Furthermore, I examine how Boullosa uses testimonies and a multiplicity of literary techniques to empower subaltern groups and to give them a space to tell history from their own perspectives.

Megan Smithers
Graduate Program: International Studies
Advisor: Lada V Kochtcheeva
Poster Number: 179

Escaping the Resource Curse: Lessons from the United Arab Emirates

Natural resources are increasingly being extracted in least developed and lower middle-income countries—thanks to technology improvements and global demand, among other factors. However, studies have shown that resource poor economies tend to outperform resource rich ones. Indeed, resource abundance is an important determinant of economic failure. They refer to this negative relationship as the resource curse. Moreover, some of the major development failures are among oil-exporting countries. This may seem surprising, given that we may assume an increase in a society's resources should increase growth. Nevertheless, some developing countries are on the opposite end of the spectrum, where natural resource abundance is a blessing. Therefore, if natural resource abundance is considered bad for development, then why do some countries with abundant natural resources grow strongly? This paper explores how the United Arab Emirates (UAE) escaped the resource curse and turned it into a boon for development. Considering the logic of the extreme case and the resource curse logic, most cases—states with resource abundance—are negative. The UAE, however, has experienced growth from its abundant natural resources, positioning it as a positive case. This rareness, therefore, makes it valuable to better understand the factors influencing growth. The UAE case provides guarded optimism that the resource curse can be mitigated or even avoided. This paper argues that it is essential for countries with abundant natural resources to not only depend on sound economic management and policies but also address the political and institutional factors that may negatively impact prosperous policies. The UAE's strategies may help guide developing countries to escape the resource curse and turn resource abundance into a blessing.

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Graduate Programs: Sociology[1]; Independent Scholar[2]; and Animal Sciences[3]
Advisor: Stefano B. Longo
Poster Number: 180

Intersectional Inequality and Distance to Farmers' Markets in New York City

Food Justice scholars argue that a localized agri-food system under current conditions will reproduce inequalities in race and class. To test this proposition, we design a mixed-method study, utilizing geographic information systems and statistics to collect and analyze data on distance to farmers' market in New York City. We hypothesize that there is a linear, positive relationship, whereby as you descend the hierarchy (move from left to right), the distance to farmers' market will increase. For quantitative data, we utilize census tract data from the US Census Bureau's American Community Survey and farmers' market data from the New York Department of Agriculture and Markets. We put the data together in ArcGIS to get a measure for distance. Then, in R, we combine our 42 variables across 2,100 cases into 11 geodemographic clusters. We conduct the cluster analysis through an unsupervised algorithm, which does not relate the independent variables to the dependent variable, distance. We then analyze the descriptive statistics for each cluster to provide a label and order them within an intersectional hierarchy. From there, we calculate Least Squared Means and pairwise contrasts for the 11 clusters. The results of this analysis are an intersectional hierarchy with a White, Capitalist Class on top and a Collective Black and Single Mothers Service-Unemployment Class at the bottom. However, the relationship between clusters and distance is non-linear, rather than linear. The ends of the hierarchy are closer and statistically different from the middle clusters. That is, mixed race, mixed income clusters are more likely in New York City to be farther away from farmers' markets than either the rich, exclusively White clusters or poor, exclusively Collective Black communities.

J. L. Stewart[1], Leigh A. Spivey[2], Laura Widman[1], Sophia Choukas-Bradley[3], and Mitchell J. Prinstein[2]
Graduate Programs: Applied Social and Community Psychology[1], Clinical Psychology, University of North Carolina at Chapel Hill[2], Psychology, University of Pittsburgh[3]
Advisor: Laura Widman
Poster Number: 183

Developmental Patterns of Sexual Identity, Romantic Attraction, and Sexual Behavior Among Adolescents over Three Years

The sociocultural contexts surrounding sexual development among youth have rapidly evolved in recent years. Despite the unidimensional manner in which sexual orientation is typically assessed, youth are heterogeneous in the ways in which they define and experience their sexualities. Three components of sexual orientation–self-labeled identity, romantic attraction, and sexual behavior–often do not align and studies suggest adolescents are fluid in these dimensions over time. However, little research exists that elucidates the developmental trajectories of sexual orientation across adolescence. The aim of this study was to examine: 1) patterns of adolescents' self-labeled identities and romantic attractions as they coincide with sexual behavior; 2) fluidity in adolescents' self-labeled identities over time; and 3) gender differences in these patterns. At baseline, 759 ethnically-diverse 9th/10th graders (54% girls; Mage=15.1, SD=.76) were recruited from a low-income, rural school district in the Southeastern U.S. At three yearly intervals, participants reported on their self-labeled identity and romantic attraction. Participants' lifetime sexual behavior with boys and girls was assessed at the final wave. At each time point, up to 19% of girls and 6% of boys reported a SM identity label with concurrent same-sex attraction; the majority of these participants also reported same-sex behavior. Among heterosexual-identified participants reporting exclusive other-sex attraction, over 11% of girls and 1% of boys reported same-sex behavior. Among heterosexual-identified participants reporting some degree of same-sex attraction, approximately 67% of girls and 9% of boys reported same-sex behavior. Many participants demonstrated fluidity in identity over the 3 years; 6% moved from a heterosexual to a SM label and 6% moved from a SM to a heterosexual label. Some youth (8%) changed labels at each of the three time points. The findings suggest that many contemporary adolescents are nuanced and dynamic in the ways in which they identify and experience their developing sexualities.

Leah Tugwell, Priscilla James, and Elizabeth Haebig
Graduate Program: Social Work
Advisor: David C. Fitzpatrick
Poster Number: 67

Impact of Mandated Reporting of Interpersonal Violence in a University Setting

It has been found that sexual assault on college campuses is an ongoing prevalent issue; however, there has been little research done on the reporting of these assaults to university personnel. This research intends to evaluate the impacts of survivors having to report to sexual assault advocates that are considered responsible employees versus advocates that are deemed confidential by the university. In order to do this evaluation, researchers will be conducting semi- structured interviews, using a formatted list of open- ended questions, with land-grant universities across the United States. The research will be purposive in that researchers are seeking out survivor advocacy centers that were one time responsible for reporting to Title IX and are now confidential. While universities do have resource centers available to survivors of interpersonal violence (IPV), all of these centers are not confidential, potentially impacting the utilization of services from survivors. Further, because survivors are skeptical of non- confidential services, researchers hypothesize that this may affect survivors' academic outcomes and could cause further trauma, hindering their long- term healing process. Should the results from the interview analyses find that service utilization is correlated with confidentiality, one could conclude that it is best practice for university sexual assault response advocates to be a confidential resource at all land- grant universities. Thus far, researchers have conducted interviews with 6 advocacy centers at land-grant institutions. Researchers have not completed the analysis at this time. It is important to note, that researchers entered the research process with a bias that confidentiality is correlated with service utilization and higher rates of positive outcomes for survivors of IPV on college campuses. Researchers will complete a thorough qualitative analysis to complete the dissemination process for the full evaluation and recommendation.

William Turner
Graduate Program: Anthropology
Advisor: John Millhauser
Poster Number: 191

How Trade with the English Effected Occupations and Movement of the Yamasee in Lower South Carolina, Leading to the Yamasee War of 1715

From 1683 to 1715, the Yamasee Native Americans moved into the Carolina colony to escape oppression from Spanish colonists. During this time, the Yamasee formed a relationship with English colonists and became close military and trade allies. After ultimately becoming a target for Native American slavery, the Yamasee rebelled, eventually leading to an end of Native people's enslavement. Even after these events, the Yamasee are only remembered by the War that holds their name. This research focuses on preserving their memory and furthering our understanding of the Yamasee's relationship with the English by analyzing trade goods found within two temporal periods. The two occupations focused on this study are Ashepoo (1685-1694) and Altamaha (1695-1715). Using archaeological records and surveys previously performed, artifacts from both occupations are sorted and counted into two groups, Native American pottery sherds and European trade goods. These counts are placed into ratios so that each site can be analyzed and compared through the amount of change that occurred over time. The results are compared to a control site known as the Fredricks site, which was occupied during the same time period as the Yamasee's occupation. This study found that over time, the English traded more goods to the Yamasee, which includes more luxury goods and fire arms. These results show that the English had growing trust with the Yamasee before the start of the war.

Felipe E. Acosta-Munoz
Graduate Program: Anthropology
Advisor: James Wallace
Poster Number: 1

Yucatec Maya Language Revitalization among Professionals' Efforts and the Role of Literacy and Language Ideology in Yucatan, Mexico

Indigenous languages throughout the Americas are increasingly endangered. For instance, in Mexico 16% of the national population spoke an indigenous language in 1930; that is more than 14 million people at that time. In 2015, only 6.6% of the total population or 7'382.785 people currently speak an indigenous language in Mexico. Even for Yucatec Maya, the second most spoken indigenous language in Mexico with more than 795, 000 speakers, intergenerational transmission of the language to new generations is compromised. In the summer of 2018, I completed my research in the state of Yucatan, with the purpose of gathering data on the efforts educators, social scientists, and other proactive participants engaged in to revitalize Yucatec Maya. A second purpose was to obtain the ideologies and experiences they bring to their profession in its revitalization. My field methods included observation, informant interviewing, and collecting of printed material in Yucatec Maya as well as digital collection of material by taking photos, and I collected my data in the urban centers of Merida and Valladolid. Despite lukewarm efforts of financial support for Maya language revitalization from the government, my data shows that my participants unanimously agree that there is insufficient legislative enforcing action to secure the linguistic and cultural rights of Maya speakers in Yucatan as delineated in the Ley General de Derechos Lingüísticos de los Pueblos Indígenas (General Law of Indigenous Peoples' Linguistic Rights) in Mexico. Among the linguistic and cultural rights my participants identify as weak there is poor infrastructure and insufficient number of indigenous schools, lack of sufficient qualified educators to teach Maya, lack of meaningful Maya pedagogic material production and distribution, and an almost non-existent prestation of public services for Maya-speakers in their language, such as medical and legal interpreting.

Audrey White
Graduate Program: Liberal Studies
Advisor: Kim L. Stansbury
Poster Number: 199

Combating Human Trafficking in North Carolina Refugee Communities

Human trafficking, also known as modern-day slavery, is a global problem that affects over 40 million people around the world. Traffickers seek out vulnerable populations that they can exploit with ease, and consequently refugee communities are a common target. Since 2007, over 5,000 refugees have been settled in North Carolina from seven majority-Muslim countries: Iran, Iraq, Libya, Somalia, Syria, Sudan and Yemen. These refugees have experienced poverty, trauma, conflict, war, and starvation and have sought safety and rehabilitation in North Carolina. However, because of their experiences, needs, and cultural and language differences, they are one of the populations most at-risk for targeting by traffickers. This research identifies problems faced by refugees, analyzes the strengths and weaknesses of the seven refugee resettlement agencies active in North Carolina, and argues that there is a significant need within the refugee community for education, training on cultural differences, and support from law enforcement and resettlement agencies in order to combat trafficking. These preventative methods can help to protect vulnerable communities, build a sense of trust between law enforcement and refugees, and halt the prevalence of the human trafficking industry in North Carolina.

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Graduate Programs: Technical Communication[1]; Communication, Rhetoric, and Digital Media[2]
Advisor: Huiling Ding
Poster Number: 101

A Rhetorical Topoi Analysis of Construction of HPV Vaccine in News Media

As a prevention from *human papillomavirus* (HPV), the most common sexually transmitted infections (STI) in the U.S., HPV vaccines have been surrounded by doubts and controversies on their effectiveness and safety. Popular media has been an important source of health information, which influences people's vaccination decisions and poses both opportunities and challenges to the public health communicators. What are the commonplaces surrounding the coverage of HPV vaccine and what are the implications for health professionals? To answer these questions, we conducted a text mining study utilizing the 28 common topics explicated by Aristotle (1960) as the theoretical framework. Collecting 91 reports surrounding "HPV Vaccine" from New York Times (NYT) published between 2010 and 2018, from Nexis Uni, we coded the texts to identify the pattern of topoi use in the discourse of HPV vaccine. Our analysis reveals a total of 3843 topoi in the NYT corpus, covering 17 out of 28 Aristotelian topoi and 8 types of new, situated topoi related to HPV vaccine. The five most common topoi include Degrees, Time, Cause & effect, Division, Compare/contrast, and Opposites, which suggest two primary rhetorical features in constructing the HPV vaccination. Many of the topoi are utilized to depict the objective facts, which helps to enhance the credibility of the arguments. By contrast, some topoi evoke sympathy from readers, urging the public to realize the various issues embedded in the uptake of HPV vaccination. These findings shed light on the effective communication of the HPV vaccine. Rhetorical awareness and appropriate reasoning approaches of researchers, journalists, and public health professionals would improve the quality and accuracy of information. Additionally, professional communicators need to consider strategies for communicating HPV vaccine controversy to the lay public. Addressing the concerns of key decision makers is also critical to strengthen the acceptability of HPV vaccine.

Jing Yuan
Graduate Program: Psychology
Advisor: Daniel Grühn
Poster Number: 207

Effects of Informal Caregiving on Cognitive Functioning and Well-being: Evidence from ELSA

As the prevalence of informal caregiving increases, the consequences of long-term caregiving on caregivers' cognitive and socioemotional functioning gain more importance for society. Consistent with stress process model, caregivers tend to report poor health and social-emotional outcomes due to higher rates of stress. However, this negative view of caregiving was challenged by healthy caregiving hypothesis and caregiving system model. Recent evidence confirmed that caregiving might enhance or maintain cognitive functioning and decrease rates of mortality and functional health. Therefore, we theorize that the duration of caregiving–from the transition into caregiving to long-term caregiving–modulates the potential beneficial and detrimental effects of informal caregiving. Using data from wave 1 (2002-2003) to wave 8 (2016-2017) in the English Longitudinal Study of Ageing (ELSA), latent growth curve models with time-varying predictor were used to investigate the accumulative effects and lagged effects of informal caregiving on cognitive function (i.e., memory and executive function) and well-being (i.e., life satisfaction and quality of life) after controlling for age effects. Over and beyond age effects, caregiving in current wave (immediate effect) was related to worse quality of life and better delayed recall and verbal fluency. Partially consistent with expectation, over and beyond immediate effect, reported caregiving in consecutive two waves and three waves (accumulative effect) was related to worse quality of life. In addition, there was significant and differential lagged effects of caregiving on cognitive functioning and well-being after controlling for immediate and accumulative effects; that is, caregiving in one wave was related to worse well-being and better memory functioning in the next two waves (i.e., about 2 years later and 4 years later) than non-caregivers. Consistent with expectations, there were differential accumulative and lagged effects of informal caregiving on cognitive functioning and well-being.

College of Natural Resources

Salonika Aggarwal
Graduate Program: Forest Biomaterials
Advisor: Marko Hakovirta
Poster Number: 3

Novel Composite for 3D Printing Using Diatomaceous Earth and Poly Lactic Acid

Alfred Nobel got his recognition after inventing dynamite. He discovered that nitroglycerin could be made much more stable if absorbed in diatomite. This allows much safer transport and handling than nitroglycerin in its raw form. Diatomite are also known as Diatomaceous Earth (D.E.), or kieselgur/kieselguhr – is a naturally occurring, soft, siliceous sedimentary rock. Dynamite stability was possible because of high porosity, high surface area and high absorption capability of diatomite. These unique properties of Diatomaceous Earth opened up ways for numerous applications of Diatomaceous Earth in diverse fields such as packaging, pest control, construction, thermal barrier safety, filtration, catalyst. This research is exploring novel 3D printing applications using Diatomaceous Earth as an additive to PLA. Comprehensive synthesis and mechanical testing results show that using Diatomaceous Earth one can reduce the cost of the 3D printing filaments by up to 20% and add new functionality to the 3D printed components. In addition, we have been able to deduct a process step that distributes the Diatomaceous Earth to the surface and thus creates new high potential applications using the high surface area and absorption capability as a value-adding functionality. These applications include for example chemical sensing and anti-microbial and anti-viral capabilities.

Steven M. Anderson[1,2], Emily A. Ury[2], Ryan E. Emanuel[1], Justin P. Wright[2], Emily S. Bernhardt[2], and Marcelo Ardón[1]
Graduate Programs: Forestry and Environmental Resources[1]; Biology, Duke University, Durham, NC[2]
Advisor: Marcelo Ardón
Poster Number: 7

Variable Physiological and Growth Responses of Six Coastal Tree Species to Experimental Salinization

Coastal wetlands are highly vulnerable to rapid changes associated with climate change, including more frequent storm events, fire, drought, and saltwater intrusion. Trees are a crucial component to maintaining ecosystem structure by controlling light availability to the soil and influencing biogeochemical cycling of nutrients and water. Our study aims to assess the response diversity of dominant tree species from freshwater forested wetlands in the Southeastern U.S. to varying levels of saltwater. Understanding species-specific stress responses to saltwater can help identify species that may provide early signals of salinity stress of forests at broader spatial scales. We performed a 6-month greenhouse experiment to investigate whole plant productivity and physiology of six tree species (*Acer rubrum*, *Juniperus virginiana*, *Nyssa sylvatica*, *Quercus nigra*, *Pinus taeda*, and *Taxodium distichum*) when exposed to a gradient of fresh to mesohaline treatments (0.2-6 ppt). We found that increased soil salinity had negative impacts on leaf photosynthesis in all species, but at different magnitudes and time points. Normalized Difference Vegetation Index (NDVI) values either increased or decreased in four of the six species in response to higher salinity. Root biomass did not change for any of the species in the upper soil horizon, however the root distribution varied across species regardless of soil salinity. *A. rubrum*, *J. virginiana*, *N. sylvatica* and *Q. nigra* allocated > 75% of their roots to the upper soil horizons, while *P. taeda* and *T. distichum* roots occupied deeper soils. The ratio of roots to shoot mass in *A. rubrum* decreased and *Q. nigra* increased with higher salinity. Although morphological stress responses across coastal tree species exposed to brackish conditions were minimal, physiological responses, in combination with leaf reflectance indexes, may prove to be reliable indications of salt stress in some coastal tree species.

Sara Brune[1], Whitney Knollenberg[1], Kathryn Stevenson[1], Carla Barbieri[1], and Michelle Schroeder-Moreno[2]
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Advisors: Whitney Knollenberg and Carla Barbieri
Poster Number: 22

The Power of Agritourism in Influencing Consumer Behavior Towards Local Foods

Increased agricultural industrialization permeates food systems resulting in a disconnect between producers and consumers. Localization of the food system empowers consumers and farmers to make informed decisions related to sustainable purchasing and agricultural practices. Consumers' engagement in local food consumption is crucial for food systems economic viability and sustainability. Agritourism—defined as participation in educational or recreational activities on working farms—is a potential space for engaging consumers' interest and participation in local food systems. Nonetheless, there is limited research assessing the influence of agritourism on consumers' behavior toward local food. Therefore, the purpose of this work is to measure whether an agritourism experience influences consumers' intentions to purchase local food. Constructs of Theory of Planned Behavior (TPB) were applied to measure intended behavior. Data were collected through a pre/post self-administered survey in October 2018 from visitors at three agritourism operations located across North Carolina. A total of 170 surveys were completed. On average respondents were 40 years old; they were predominantly female, highly educated, and earn high incomes. Cronbach's alpha was used to confirm the internal reliability of the scales. Repeated measures multivariate analysis of variance ($p < 0.05$) was used to contrast survey responses on their attitudes, subjective and personal norms, perceived behavioral control, and intended consumer behavior of local food before and after participants' engagement in agritourism. Results indicate that agritourism positively influences attitudes, personal norms, and intended consumer behavior towards local foods. This study concludes that agritourism is a space for consumers to reconnect with local foods. Altogether, this study builds towards an underexplored additional benefit of agritourism as a strategy to promote local food consumption and food system sustainability. These findings will also help to establish a path for policy to strengthen local food systems through tourism and recreational activities.

Megan Coffer
Graduate Program: Geospatial Analytics
Advisor: Helena Mitasova
Poster Number: 37

Assessing the Frequency of Cyanobacterial Blooms in Waterbodies Across the United States

Cyanobacterial harmful algal blooms (cyanoHAB) are a significant environmental concern. Exposure through recreational activities or the consumption of contaminated drinking water can have substantial economic and human health impacts. Despite claims that cyanoHAB events will become increasingly critical in coming years, little research exists to quantify the frequency of these events, or to investigate if this frequency has changed in recent years. This study analyzes the frequency of cyanoHAB occurrence across 2,321 National Hydrography Dataset (NHD) waterbodies within the continental United States (CONUS), excluding the Great Lakes, for the years 2008-2011. The European Space Agency's MEdium Resolution Imaging Spectrometer (MERIS) was used to estimate the concentration of cyanobacteria at the top of the water column. Waterbodies containing at least three valid 300 m2 satellite pixels were included for analysis. CyanoHAB frequency was calculated for each month of data as the proportion of satellite weekly composites in which a satellite pixel indicated a detectable bloom (microsystis equivalent > 10,000 - 20,000 cells mL-1) out of all valid satellite weekly composites. Monthly bloom frequency was then summarized for each state within CONUS. Two nonparametric tests, the seasonal Mann-Kendell test for trend and the seasonal Sen Slope, were applied to monthly aggregated data for each state to quantify if the frequency of cyanobacterial blooms changed from 2008-2011. Preliminary results suggest a fairly even split across CONUS with half of the states indicating an increase in cyanobacterial occurrence and half indicating a decrease. Approximately 20% of states indicated a statistically significant change which was also fairly evenly split between those that increased and those that decreased. Quantitative insight into the frequency of cyanobacterial events can assist stakeholders in identifying waterbodies with increasing cyanoHAB occurrence. These locations can then be prioritized for effective distribution of resources to control and manage bloom events.

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Graduate Programs: Parks, Recreation and Tourism Management[1]; Geospatial Analytics[2]
Advisor: Bethany Cutts
Poster Number: 213

Identifying the Intersection between Restoration and Cultural Ecosystem Services

Ecological restoration is promoted as a promising solution to environmental change and degradation. In Southwest New Mexico, the Bureau of Land Management's Restore New Mexico restoration initiative implements extensive herbicide application to address the widespread encroachment of invasive woody shrubs across desert grasslands. This region is rich in culture, history, and lifestyles interwoven in the landscape, where landscape change has implications for society. While empirical data informs of ecological change, research suggests a deeper investigation into the socio-cultural impacts of restoration management. Failing to account for socio-cultural values can lead to injustices and contention between the public and management groups. Further, it could omit evidence that supports the cost- and time-intensive efforts of restoration management as beneficial to both the environment and society. Cultural ecosystem services (CES) explain the nonmaterial benefits to society provided by ecosystem processes through recreation, aesthetic experiences, spiritual enrichment, and intellectual development. This study uses the language of CES to capture the impacts of restoration on society and culture in Southwest New Mexico. Semi-structured interviews of open-ended questions with diverse stakeholders reveal perceived CES and their interaction with restoration management. The study demonstrates a vast array of CES perceived by participants; however, results reveal shifting socio-cultural and economic interactions with the grasslands. Given that management objectives predate these emerging CES, there exists a need to reassess the goals for restoration, especially as associated contention and perceptions of threat among diverse user groups grow. Creating a pathway to understanding the complexity of the human-environment relationship on changing landscapes, this study will enhance discussion on land management in Southwest New Mexico. This information can assist in finding both equitable and ecologically optimal solutions for restoration management, improving alignment between land management and socio-cultural priorities of stakeholders.

Jenna M. Hartley[1], M. Nils Peterson[2], Elizabeth DeMattia[3], Renee Strnad[2], Sarah Carrier[4], K.C. Busch[4], and Kathryn T. Stevenson[1]
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Advisor: Kathryn T. Stevenson
Poster Number: 73

Intergenerational Learning Beyond the Immediate Family: Are Students Environmental Change-agents in Their Communities?

Marine debris has become a global environmental crisis and disproportionately affects North Carolina (NC), home to the second largest coastal ecosystem in the country. Although numerous technical solutions to deal with marine debris have been developed, successful implementation hinges on backing from an environmentally-literate citizenry. Unfortunately, there are several barriers to building an environmentally-literate citizenry, such as low scientific literacy and politicization of environmental issues.But developing research gives us reason for hope. Environmental education (EE) among K-12 audiences may be a promising pathway to promote environmental literacy (EL) among adults. EE research has identified strategies for building EL among children, including interventions that are locally based, hands-on, and action-oriented. Pairing these techniques with intentional outreach to older generations through their children may build EL among adults through intergenerational learning, or IGL. IGL may affect change beyond parents and impact communities, community organizers, and elected officials. My PhD research investigates this community-level IGL pathway with a specific focus on marine debris. My research examines the IGL outcomes associated with a community- and citizen-science-based EE curriculum for 4th and 5th grade students across the entire state of North Carolina. We hypothesize that student participation in the program will lead to increased knowledge of marine debris, environmental self-efficacy, pro-environmental behavior, and interest in STEM-based careers. We further hypothesize that parents, local officials, and community members will report higher saliency of marine debris and perceived importance of using scientific data in environmental decision-making after watching local students present their results. For this treatment-control experimental design, we have recruited 22 teachers and randomly assigned them to treatment (n = 14) and control (n = 8) groups. We trained the treatment teachers in the marine debris curriculum and collected pre-test data. This poster provides background and preliminary data linking child and parent views on marine debris.

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Poster Number: 102

Northern Bobwhite Winter Habitat Selection in Southeastern Pine Woodlands

Northern bobwhite (hereafter quail) populations have declined throughout their range. Though much research has been conducted on quail breeding-season habitat selection, winter habitat selection remains understudied. Over a 3-year period, we used radiotelemetry to evaluate quail winter habitat selection in longleaf pine woodlands of the sandhills region of North Carolina. At the microsite scale (the exact location where quail were located), woody understory cover emerged as the most significant positive predictor of selection ($p < 0.001$), followed by switchcane cover (*Arundaria tecta*) and forb cover (both $p < 0.001$). In addition, quail selected areas with lower pine and hardwood basal area ($p < 0.01$ and $p < 0.05$, respectively). We identified stand-level predictors of quail habitat use in each year of the study. Quail used areas with combined basal area 16.2-21.6 m^2/ha more than available and areas 0-5.4 and 10.8-16.2 m^2/ha less than available in 2016. Quail selected basal areas 5.4-10.8 m^2/ha and avoided basal areas with >10.8 m^2/ha in both 2017 and 2018. Quail used areas 0 and 2 years since fire less than available in 2016, but time since fire did not affect selection in 2017. Quail used areas 0 years since fire less than available and areas 1 year since fire more than available in 2018. Quail used large fields and upland pines less than available and used bottomlands more than available in 2016 and 2018, respectively. We detected no significant selection by vegetation community type in 2017. Woody understory cover, which provides critical thermal and escape cover, was the key driver of quail habitat selection in winter.

Nicholas Kruskamp
Graduate Program: Geospatial Analytics
Advisors: Ross K. Meentemeyer and Josh M. Gray
Poster Number: 103

Time Series Remote Sensing for Prioritizing Forest Disease Management

Spatially-explicit epidemiological models may enable land managers to take proactive steps against forest disease spread. These geospatial tools have tended to focus on staying ahead of disease in order to slow or stop spread, helping identify areas where disease treatment, such as host species eradication, should occur. However, few studies have focused on monitoring of post-management forest sites which may be susceptible to re-infection. A major challenge lies in identifying areas which should be revisited in subsequent years due to the reemergence of host species. Therefore, we propose methods to employ dense time-series remote sensing to characterize forest response following disease management. This approach allows for cost-effective monitoring of forest conditions across broad geographic extents, providing land managers a tool to identify areas that may need to be revisited. In this study, sudden oak death (SOD) in southwest Oregon, USA is used as a case study where intensive management has been employed to stop disease spread. We used the Continuous Change Detection and Classification (CCDC) algorithm to analyze dense time series Landsat satellite images from 2000 to 2018. Using spatial data provided by the Oregon Department of Forestry, we examined how well the CCDC algorithm detected spectral change in the year SOD management occurred and spectral signature trends in the years following treatment. Results indicate that the CCDC algorithm was moderately effective at identifying pixels which underwent change due to management, but remote change identification tended to lag one year behind reported management actions. Spectral response following management was varied across the study region, suggesting that some areas return to their pre-management conditions while others undergo a state change. This study demonstrates the effectiveness of time-series remote sensing as a cost-effective way for land managers to track forest response following disease treatment.

Kai Lan
Graduate Program: Forest Biomaterials
Advisor: Yuan Yao
Poster Number: 104

Integrating Life Cycle Assessment and Agent-based Modeling: A Dynamic Modeling Framework for Sustainable Agriculture Systems

Agriculture is one of the largest sectors contributing to greenhouse gas (GHG) emissions in the USA. As food demand increases, it is critical to develop effective strategies and evaluate their potential in reducing GHG emissions and other environmental footprints of agriculture systems that consist of a large number of farms. However, this is challenging because individual farm may have different responses to the same strategy and farmers' decisions will have impacts on the environmental footprints of overall agriculture systems. This study addresses the challenge by developing a dynamic system-modeling framework integrating life-cycle assessment (LCA), agent-based modeling (ABM), and techno-economic analysis. Each farm is modeled as an autonomous agent who can make decisions on plantation activities each year based on the attributes and interactions with other farms. LCA and techno-economic analysis are coupled with dynamic simulation models of crop yields, costs, and prices. Different scenarios of 1,000 farms at North Carolina in future 30 years are simulated to investigate the impacts of farms' attributes, socio-economic factors, and intervention strategies on farmers' decision-making and the environmental impacts of overall agriculture systems. The preliminary results indicate that information exchange among farmers, farmer's environmental awareness, access to environmental footprint information, and farm size are key factors driving the results of environmental impacts. Educational interventions that can enhance farmers' environmental awareness and provide feedback on environmental impacts of farmer's decisions have a potential of 5% to 18% reduction of Global Warming Potential and eutrophication. The results can provide a broad range of stakeholders (e.g., policymakers, nonprofits, agriculture companies) with insightful information to tailor their strategies for effectively managing the environmental footprints of large-scale agriculture systems. The integrated modeling framework has the potential to address sustainability challenges in other systems that are dynamic, involve human behaviors, and have complex interactions among human and nature systems.

Danielle F. Lawson
Graduate Program: Parks, Recreation and Tourism Management
Advisor: Kathryn Stevenson and Nils Peterson
Poster Number: 108

Adolescents as Climate Communicators: New Methods for Engaging Everyone in the Climate Change Conversation

As issues associated with climate change grow increasingly complex, the need for a citizenry prepared to address them cannot be overstated. Unfortunately, ideologically polarized contexts render climate change education and communication efforts challenging or ineffective among US adults. Promisingly, however, recent research suggests that adolescents are more capable than adults of separating climate science facts from their ideological contexts when forming perceptions. Communication strategies that leverage children's perspectives on climate change to reach the adults in their lives, may make inroads to climate action where other strategies have failed. Intergenerational learning (IGL), a sub-theory of sociocultural theory, posits that interactions between two generations can result in the bidirectional transfer of knowledge, attitudes, and/or behaviors. IGL is not new – marketing experts have long relied on advertising strategies that target children, and environmental education efforts directed at children have been associated with environmental learning in adults. However, IGL has not been tested within the realm of controversial environmental topics such as climate change. To fill this gap, I used a pre-post, treatment-control, quantitative survey to test the effectiveness of a climate-change based, environmental education curriculum, designed to maximize the chance of IGL occurring from children their parents. Based on the data associated with 238 families from coastal North Carolina, results show that the curricular treatment not only increased children's level of climate concern, but also their parent's, through direct communication from their children. Furthermore, the treatment was most effective with parents who identified as conservative or male, or when the communication came from daughters. As such, the results suggest that IGL initiatives in the climate change context may be a key in moving towards a future defined by increased climate concern, and in turn, action.

Mochen Liao, Stephe S. Kelley, and Yuan Ya
Graduate Program: Forest Biomaterials
Advisors: Stephen S. Kelley and Yuan Yao
Poster Number: 113

Quantifying Energy Demand and GHG Emissions of Activated Carbon Production From Diverse Woody Biomass: An Predictive Modeling Framework of Artificial Neural Network and Kinetic Based Simulation

The utilization of biomass to replace coal as the feedstock for activated carbon (AC) has become attractive in recent years due to its potential to reduce process energy demands and greenhouse gas (GHG) emissions, and these are evaluated by some researchers using life cycle assessment (LCA). However, all these studies have been limited to a few specific feedstocks, operational conditions, and technology routes, which may not be applied to a wide range of feedstock and technologies. Therefore, the predictive model is developed in this study in order to simulate the environmental impacts of AC production from different feedstocks and technologies, thus the impact of feedstocks and technologies could be evaluated. The predictive model for energy demand and GHG emissions associated with AC production is developed by integrating process-based simulation, Artificial Neural Network (ANN) and pyrolysis kinetic model (Bio-PoliMi). A large dataset of biomass characterization, operational conditions of pyrolysis and activation, and AC yields were collected from literature and used for ANN training and validation. Aspen Plus simulation was developed based on predicted yield and the kinetic model to generate life cycle inventory (LCI) data of the whole process. The integrated modeling framework is able to estimate the energy demand and GHG emissions of AC produced from woody biomass. Based on these estimated values, some preliminary results are summarized to reflect the impact of feedstock properties. For example, we found that as the hydrogen content of the woody biomass increased the energy demand of steam activation increase due to a decrease on the mass yield. In addition, the integrated methods, e.g., kinetic modeling, ASPEN modeling, and ANN, developed in this work. have the potential to be applied to other manufacturing processes, especially emerging technologies that lack LCI data.

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Advisor: Marcelo Ardón
Poster Number: 122

Partitioning Inorganic Carbon Sources in a Lowland Tropical Stream, Costa Rica

Tropical streams play an important role in the global carbon cycle, but the controls of carbon dioxide (CO_2) concentrations and efflux to the atmosphere are poorly constrained. We combined estimates of whole stream metabolism with measurements from total dissolved CO_2 sensors, measuring the partial pressure of CO_2 (pCO_2). Combining the two approaches, we can partition two sources of inorganic carbon to the stream: 1) biological respiration from estimates of ecosystem respiration (ER) and 2) groundwater CO_2, which is calculated as the difference between total and biologically-derived CO_2. Our results confirm hypotheses on tropical stream energy sources (primarily allochthonous) and the stream as a source of CO_2 to the atmosphere. Groundwater sources of CO_2 were 4x greater than biological sources on average, though there was no increase with groundwater CO_2 with discharge as predicted, likely as a result of dilution from precipitation. This novel approach informs metabolic data on tropical streams and quantification of the landscape-stream interaction. Future work will expand the number of study sites and diversity of tropical systems studied.

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Advisor: Helena Mitasova
Poster Number: 130

Stress3d: Mapping Cyclists' Physiological Responses to Inform Urban Planning

How people respond to a place depends on any number of factors. Examining these factors could improve our understanding of how human behavior varies across space and determines our perceptions of a place. This would be of considerable interest to those responsible for designing the spaces in which these behavioral patterns occur, specifically lending great insight to urban and city planners. Yet, research employing spatial-behavioral analyses is drastically limited. Furthermore, spatially analysing human behavior is extremely complex due to the spatio-temporal, multi-scale (i.e., city, region, street), and multivariate aspects of spatial-behavioral data. This is especially the case considering current methods and visualization tools lack the ability to systematically explore, identify, and improve upon factors that affect qualities of urban space. To help minimize the gap seen in spatial-behavioral knowledge, we developed an interactive 3D application—Stress3d—using location and physiological-tracking data to visualize spatio-temporal physiological data in a rich, geospatially-situated context. Urban and city planners can use it to gain valuable insight into which spatial configurations contribute to both favorable (and unfavorable) physiological states of those who use those spaces; to then develop high-quality urban spaces through a more evidence-based design, in comparison to traditionally subjective methods. Designed as a research tool, Stress3d's overall development is motivated by its ability to assist researchers in the fields of urban planning, environmental health, and epidemiology better direct their research efforts when exploring how human behavior varies as a function of location, space, and time. Additionally, Stress3d's system framework is capable of handling most formats of spatiotemporal data, specifically physiological data, which can then be intuitively visualized and explored. As such, this platform is valuable for many examinations of how geographic contextual factors, including exposure to nature, the built environment, the food environment, air pollution, light pollution, noise, and socioeconomic factors, impact human behavior.

Kellyn P. Montgomery
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Advisor: Helena Mitasova
Poster Number: 133

Canopy Structural Patterns for Identifying Yield Variability in Grain Sorghum

Deriving crop information from remotely sensed data is a critical component of food security and sustainability efforts such as precision agriculture, soil conservation, and agroecological modeling. Small unmanned aerial systems (UAS) have emerged in recent years as a versatile remote sensing tool used by scientists and agricultural producers for collecting data at very high spatial and temporal resolutions. UAS can provide precisely-timed, fine-grained data for informing management responses to intra-field variability for maximizing crop productivity while minimizing natural resource degradation. Vegetation indices, like Normalized Difference Vegetation Index, calculated from remotely sensed spectral information have been shown to strongly correlate with crop health and are widely used in industry and throughout the literature. Many multispectral sensors for UAS, however, are limited by high cost and low spectral resolution. Furthermore, there has been very little exploration of the use of 3D models of canopy structure to provide information about crop health, population, and stand uniformity. Thus far, techniques for quantifying the geometric properties of morphological surfaces have been limited to terrain landforms. This research goes beyond spectral analysis for remote crop monitoring to investigate the relationship between grain sorghum yield and patterns in canopy height spatial variance over a time-series of photogrammetric canopy surface models obtained by a small UAS with a consumer-grade RGB camera. Techniques used for quantifying geomorphologic surface structure were evaluated for their usefulness in characterizing canopy structure. Additionally, we analyzed the impact of parameters used in image processing and point cloud interpolation on canopy model geometry and feature identification. This approach for leveraging 3D canopy structure provided valuable information for characterizing crop productivity and may improve crop yield predictions when combined with spectral data.

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Advisors: Krishna Pacifici and Roland Kays
Poster Number: 145

Spatial Variation in Landscape Composition and Configuration Effects on White-tailed Deer Abundance

The proliferation of citizen science efforts has resulted in animal occurrence data over large geographical areas that span many years, requiring novel and increasingly complex analytical techniques to accurately discover patterns in these data. We are finding that these big data sets have spatial and temporal autocorrelation, and that relationships change over large scales (i.e. non-stationarity), meaning that non-spatial and stationary regression models are inadequate for exploring such data. Using observations from volunteer-run camera traps from the North Carolina Candid Critters project and eMammal, we present results from spatially varying coefficients (SVC) models fit using Integrated Nested Laplace Approximation (INLA) aimed at exploring potential space-varying effects of covariates on the relative abundance of white-tailed deer across North Carolina, USA. We model deer abundance as a function of common covariates known to influence deer including the proportion of forest cover, agriculture, and housing density within a 5 km^2 buffer of a camera site, as well as a measure of variation in land-cover configuration–all of which were statistically modeled to allow the effect to vary spatially. Finally, we extend the SVC model to allow the space-varying covariate effects to also vary over time through an AR1 correlation structure using four seasons. Spatially-varying coefficients models had improved model fit over non-spatial and/or stationary models and provided a flexible modeling framework for exploring and accounting for non-stationary processes driving patterns in large scale citizen science data. While we did find notable variation in ecological relationships, few locations had statistically significant effects, suggesting that the generalist nature of deer held true across most of the state. Future work includes extending this modeling framework to the mammal community of North Carolina while integrating multiple sources of data.

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Advisor: Lincoln Larson
Poster Number: 146

The Mood Meter: A Tool for Measuring Emotional Responses to Wildlife

After years of focusing nearly exclusively on cognitions, researchers are now recognizing the important role of affect in human-wildlife interactions. When it comes to emotionally charged human-wildlife encounters, an individual's sense of fear, calm, excitement, or anger may influence their behavioral response. However, emotions are notoriously difficult to measure. This study introduces a new method to measure people's emotional responses toward wildlife: an adapted version of Yale's Center for Emotional Intelligence's Mood Meter. The scale is divided into four quadrants each representing different sets of feelings based on pleasantness (*x*-axis) and intensity levels (*y*-axis). We sought to validate the Mood Meter for use in a wildlife context by surveying adults (n = 113) at the North Carolina Museum of Natural Sciences in February 2018 and February 2019, and students (n = 27) at a Raleigh, North Carolina middle school during spring of 2018. Respondents were asked to complete a survey containing open-ended, scaled, and Mood Meter questions about their feelings if they were to see a deer and a coyote near their home. Emotional responses to deer were similar for adults and youth, with both groups reporting feeling calm and relaxed (low intensity, high pleasantness). Emotional responses towards coyote differed among adults and youth, with adults typically feeling tense and surprised (high intensity, low pleasantness) while youth typically feeling happy and excited (high intensity, high pleasantness). Triangulation of results combining other items with Mood Meter responses suggest the adapted Mood Meter scale is a valid and reliable tool for assessing emotional reactions to wildlife. The Mood Meter could be used to assess affective dimensions of human-wildlife interactions to predict potential behavioral responses in a variety of contexts. Currently, we are using the tool to explore the impacts of North Carolina's Candid Critters citizen science project on participants' wildlife attitudes and behaviors.

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Advisor: Hasan Jameel
Poster Number: 206

Production Optimization of NFC by Probing Its Reactivity for Controlled Surface Grafting to Maximize the Performances

Nanofibrillated cellulose (NFC) has garnered significant attention as the use of sustainable biomaterials and green technologies in drug delivery, hydrogels, synthetic membranes, and green flexible electronics is increasing. However, despite advances in NFC synthesis processes, existing processing strategies still rely on intensive mechanical grinding whose quality of production is often measured by physical changes such as fines. The old approach completely overlooks chemical changes such as exposure of large numbers of hydroxyls which significantly compromises desirable properties. To overcome this limitation, we developed a simple processing technique to prepare NFC samples with different levels of fibrillation and fines by controlling mechanical energy. A mild acetylation reaction was used to probe changes in NFC chemical reactivity while preserving the integrity of the original morphology and native crystalline structure. Also, a new and accurate degree of substitution (DS) measurement method was used to quantify surface modification of NFC. DS increased with mechanical energy to reach a maximum value and dropped after continuing to increase the energy levels despite reaching the highest level of fibrillation and fines content. This behavior was due to the presence of higher bound water in the fibrillated surfaces and enhanced self-aggregation of surface hydroxyl groups of NFC at higher fibrillation. These two reasons are regulating factors for any possible chemical reactivity because water molecules hinder accessibility to cellulose chains by increasing close packing of the nanofibrils and self-aggregation diminishes availability of the surface hydroxyl groups. The findings indicated that the chemical reactivity of NFC at different levels of fibrillation along with physical changes through fibrillation and fines generation should be considered as control measures for the efficient production of NFC. This study provides a promising ecofriendly strategy for efficient and sustainable production and modification of NFC through targeted surface grafting that can ultimately optimize performance in different applications.

Vivi Selviana
Graduate Program: Natural Resources
Advisors: Erin Sills and Robert C. Abt
Poster Number: 177

Learning Lessons from a REDD+ Initiative: Assessing the Implementation Process, Forest and Community Outcomes, and Impacts on Local Households in Central Kalimantan, Indonesia

The traditional rural population of Indonesia is highly dependent on forests for both products and services for both market and subsistence. Thus, their livelihoods are threatened by economic development activities that lead to deforestation. In this context, international efforts to reduce emissions from deforestation and forest degradation, or REDD+, can potentially be a win-win for local and global populations, protecting livelihoods while mitigating climate change. However, there is significant controversy over whether REDD+ can achieve this potential. The controversy partly reflects highly varied understandings about what REDD+ really is and how it is being implemented on the ground. To shed light on this debate, we present a detailed explanation of how one REDD+ project has been implemented and a counterfactual-based evaluation of its livelihood impacts. The Katingan Mentaya Project was launched in 2009 and issued its first carbon credits in 2017. To generate these credits, the project proponent implemented a bundle of interventions, which we categorize as restrictions on forest access and/or conversion, forest enhancement, non-conditional livelihood enhancements, conditional livelihood enhancement, environmental education, and tenure clarification. Drawing on community meetings and household survey data collected at three points in time (2011, 2014, and 2018), we examine trends and estimate difference-in-difference models to quantify the impacts of these interventions on income from the forest, forest clearance for agriculture, and in- and out- migration.

Matt Snider
Graduate Program: Fisheries, Wildlife, and Conservation Biology
Advisor: Roland Kays
Poster Number: 181

Constant Neighbors: Leopard Home Range Variation in an Increasingly Human World

Wildlife conservation on a landscape scale requires an accurate understand about the ways in which habitats are used by resident mammals. Human populations are having an increasing impact on wildlife populations, especially those species with relatively large home ranges. As cryptic, generalist predators who have frequently shared habitats with humans, leopards are an ideal model for studying human impacts on wildlife space use. Leopards are clearly sensitive to human disturbance, as they now occupy less than 40% of their historic geographic distribution, but they are known to still coexist with people in both high and low human density. Thanks to improved GPS technology, high quality leopard ranging data is now available. Combined with new analytical techniques designed to account for different sampling regimes, we are now able to compare leopard home range use along a human density gradient, while also accounting for environmental factors. Using data from over seventy individual leopards collected from ten collaborative projects in seven countries, I have applied a newly developed analytical technique called autocorrelated kernel density estimates and found that average home range size varies widely by country. Ranging from largest to smallest, these average home range sizes by country are Namibia (374.8 km^2), Iran (280.3 km^2), Oman (154.8 km^2), South Africa (93.2 km^2), Botswana (71.5 km^2), Kenya (43.3 km^2), and India (25.7 km^2. Deeper analyses revealed that more productive landscapes result in smaller leopard home range sizes. The relationship between human density and leopard home range size appears more nuanced. Leopard home range size increased with rising human population density in closed habitats (dense scrub landscapes) but decreased with increasing human density in open habitats (like savannah or cultivated agricultural land). This study sheds light on the complex nature of carnivores sharing space with humans in an increasingly developed world.

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Advisor: Ronalds Gonzalez
Poster Number: 208

Application of Micro- and Nanofibrillated Cellulose (MNFC) in Hygiene Tissue Products

The development of novel technologies and materials to face current and future market challenges related to fiber supply, quality and cost is a topic of high interest for the hygiene tissue industry. Micro- and nanofibrillated cellulose (MNFC) presents an opportunity to modify tissue paper features due to its superior strength properties. This has triggered a growing interest in using MNFC to generate either high-value applications or low-cost alternatives. This work aims to develop a systematic study on the use of MNFC in hygiene products with a focus on tissue paper. To that end, MNFCs produced from four different market pulps were added to tissue-making slurries of virgin fibers at different loads. Results show that MNFCs act as an effective strength additive for tissue paper, however, there is a tradeoff between the strength gains and the changes in other properties such as bulk, water absorbency, and softness, which are negatively affected. The extent of the changes depends on both the load and the type of MNFC. As strength requirements are necessary to withstand tissue-manufacturing operations, this allows tailoring the final tissue properties according to the application for which each hygiene product is designed.

College of Sciences

David A. Bullock
Graduate Program: Genetics
Advisor: Anna Stepanova
Poster Number: 25

Exploration of The Molecular Basis of The Ethylene Fast Response

Ethylene is a gaseous phytohormone involved in multiple aspects of plant growth and development. At the molecular level, the developmental effects of ethylene are accompanied by significant changes in gene expression at both transcriptional and post-transcriptional levels. The fast phase of the response to ethylene is thought to be independent of transcription, but its molecular nature is currently unknown. My project aims to shed light on the molecular basis of the fast ethylene-mediated response. Towards this goal, I am working on completing the following five objectives. First, I implemented high-throughput live infrared imaging to monitor seedling growth dynamics with the help of a custom-made MatLab software developed in our lab. Second, using a semi-automated pipeline, I evaluated the roles of auxin in the fast response to ethylene. Using our established high-throughput live infrared imaging system, I have assessed the ethylene phenotypes of a set of previously characterized auxin mutants and wild-type plants treated with an auxin inhibitor kynurenine and discovered that auxin is required for the fast response to ethylene. Third, I am working on confirming the hypothesis that the fast response is transcription independent. My goal is to generate CRISPR/Cas9 knockouts of the remaining family members in the ein3-1 eil1-1 mutant background and to examine ethylene response in these higher order mutants. My fourth objective is to address the possibility that the fast response to ethylene is regulated at the translational level. I aim to characterize T-DNA knockouts corresponding to ethylene-responsive translational targets and study their growth dynamics through a growth response kinetic assay. My fifth and last objective is to address the role of ETHYLENE INSENSITIVE2 (EIN2), a key ethylene signaling molecule, in the fast ethylene response. Cumulatively, my project is expected to expand our knowledge of the ethylene-triggered fast response.

Madison L. Davidson
Graduate Program: Chemistry
Advisor: Wei-chen Chang
Poster Number: 43

Redirecting the Reaction Outcome of Iron 2-Oxoglutarate Dependent Oxygenases from Hydroxylation to Nitrile Formation

Functionalization of aliphatic C-H bonds has been a central focus in synthetic chemistry as well as chemical biology. Traditional C-H activation strategies rely heavily on transition metal catalysts; halogenated solvents, or harsh reaction conditions. Moreover, these methods are still lacking in regio- and stereo-selectivity. Mononuclear non-heme Fe(II) – and 2-OG dependent oxygenases comprise a large family of enzymes that utilize an Fe(IV)-oxo intermediate for the initiation of diverse oxidative transformations such as hydroxylation, halogenation, ring formation, and desaturation. This diversity of function allows for the production of catalytic novelty – providing access to highly chemo – and enantioselective compounds. Understanding the biosynthetic logic of these transformations in non-heme Fe(II) enzymes could allow for enzymatic re-direction to yield novel non-proteinogenic compounds with promising biological activities. Three enzymes, IDO (L-isoleucine-4-hydroxylase), LdoA (L-leucine-5-hydroxylase) and DiOH, have been investigated. We aim to re-direct the reaction outcome to convert these hydroxylases into nitrile forming enzymes using a non-canonical azido amino acid derivative. Herein, we carried out substrate analog and product synthesis, and protein over-expression and purification to start to elucidate nitrile formation mechanisms.

Dorothy You
Graduate Program: Toxicology
Advisor: James C. Bonner
Poster Number: 205

Nickel Nanoparticles Enhance LPS-Induced Pro-Inflammatory Cytokine Production via a NF-kB-dependent Pathway in Human Lung Epithelial Cells *in vitro* and Promote Acute Lung Inflammation in Mice *In vivo*

Nickel nanoparticles (NiNPs) are widely used in various industrial applications such as catalysts for the production of multiwalled carbon nanotubes. Thus, the toxicity of NiNPs after inhalation exposure is a major concern for occupational lung diseases. Pre-existing respiratory disease or the sex of the individual, may influence one's susceptibility toward exposure to NiNPs. Pre-existing lung inflammation can be induced by lipopolysaccharide (LPS), a ubiquitous component of gram-negative bacteria. Both LPS and NiNPs activate the toll-like receptor, TLR4. We hypothesized that NiNPs would exacerbate LPS-induced lung inflammation through amplification of TLR4 signaling intermediates (e.g., NF-kB, MyD88) to enhance cytokine production and lung inflammation. An immortalized human bronchial epithelial cell line (BEAS-2B) was stimulated with LPS, NiNPs, or both. Cell supernatants and mRNAs were collected after 24hrs after the treatment to measure IL-6 and IL-8 mRNA and secreted protein by RT-PCR and ELISA, respectively. The IkB kinase inhibitor, TPCA-1, was used to inhibit activation of NF-kB. To determine whether NF-kB plays a role in NiNP exacerbation of LPS-induced inflammation, BEAS-2B cells were treated with TPCA-1 (5uM or 10uM) 30 minutes prior to LPS and NiNP stimulation. Male and female mice were treated with vehicle (0.1% Pluronic in PBS), LPS (5ug/kg), NiNPs (4mg/kg), or both LPS and NiNPs. Necropsy was performed 24 hours post-exposure. NiNPs and LPS synergistically increased IL-6 and IL-8 production both at the mRNA and protein level in BEAS-2B cells. TPCA-1 blocked the synergistic increase of IL-6 and IL-8 caused by LPS and NiNP co-exposure in BEAS-2B cells. The *in vivo* study also revealed that male mice were more susceptible to acute lung inflammation caused by either LPS and NiNPs compared to female mice. These findings suggest that co-exposure to NiNPs and LPS would result in more severe lung inflammation in humans compared to either agent alone, especially in males.

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Advisor: Carla Frohlich
Poster Number: 59

Using PUSH to Explode Massive Stars

Massive stars end their lives as core-collapse supernova. These supernovas are known to be major sites for the formation of heavy elements. Full-fledged core collapse supernova simulations are computationally too expensive to perform routinely. Therefore, we need a computationally efficient model to study, for example, their nucleosynthetic yields. While core-collapse supernova simulations in spherically-symmetric one-dimensional model are computationally efficient, they fail to explode. The PUSH method can cause effective explosion of such non-exploding models. The PUSH method takes a fraction of the heavy flavor neutrino energies and deposits it in the gain region behind the shock wave in the supernova. In this work, we investigate the explosion properties and nucleosynthetic yield of evolved stars obtained from different stellar evolution models using the PUSH method and different nuclear equation of states. We then compare our results with observed supernovae.

Amanda R. Hale
Graduate Program: Biological Sciences
Advisor: Ann H. Ross
Poster Number: 68

Do Developmental Modules Accurately Reflect Phylogenetic Relationships? A Test Using Extant Non-human Primate Crania

Extant non-human primate models are utilized to interpret the morphological variation in hominid fossils necessitating a clear understanding of craniofacial morphological patterns and their associated phylogenetic relationships. Craniofacial morphology is thought to operate on two levels: developmental and functional. Developmentally, the chondrocranium ossifies endochondrally while the dermatocranium ossifies intramembranously. Researchers have proposed that since endochondral ossification has been evolutionarily more stable the chondrocranium should better reflect molecular phylogenies. To test this assumption, 32 coordinate neurocranial (representing chondrocranium) and facial (representing dermatocranium) anatomical landmarks. Seven genera of extant non-human primates are represented with the total sample containing 139 male crania only to control for sex-related effects. Following Generalized Procrustes Analysis transformation, a canonical variates analysis (CVA) was performed to examine among group variation. Mahalanobis D^2 for each developmental module was used to examine group dissimilarity. For the chondrocranium, CAN_1 and CAN_2 represent 65.286% of the total variation with 56.057% of the variation on CAN1 separating great apes from Old World monkeys. The D^2 values show that Colobus and Papio are the most dissimilar Old World monkeys, consistent with molecular studies. However, Gorilla ($D^2 = 7.2037$) is more closely related to Pongo rather than Pan ($D^2 = 8.1402$). In the dermatocranium, CAN_1 and CAN_2 represent 78.016% of the total variation with 50.375% of the variation separating the great apes and Old World monkeys with the latter more homogenous in the dermatocranium. The D^2 values, however, show Pan and Gorilla ($D^2 = 11.18$) more similar than either are to Pongo ($D^2 = 13.47$ and 12.24). Preliminary results suggest that while variation in the chondrocranium separates great apes and Old World monkeys, D^2 values are not congruent with molecular data in great apes. The dermatocranium shows more congruency with molecular distances, but the variation indicates more similarity between great apes and Old World monkeys than accounted for in molecular studies.

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Advisor: Seth Kullman
Poster Number: 100

Understanding the Link Between Vitamin D Deficiency and Obesity

Vitamin D (VD3) is a steroid hormone traditionally associated with bone homeostasis; however, accumulating evidence suggests a wider biological role for VD3 and its importance in additional physiological processes. In recent years, the VD3 signaling axis has been implicated in metabolic control, where low systemic VD3 levels are associated with obesity. Of particular interest to our lab, is how vitamin D deficiency (VDD) serves as a precursor to obesity through its' role in the dysregulation of growth hormone and insulin signaling. To investigate the role of VD3/VDR in obesity, we established three dietary cohorts of zebrafish placed on engineered diets: a standard lab diet control (LD; 1.4 iu/g), a VD3 null diet (0 iu/g), and a VD3 enriched diet (400,000 iu/g). We show that when zebrafish switch over from a standard LD to a VD3 null diet at 2-months post fertilization (mpf), they develop central adiposity, and stunted growth accompanied by decreased bone mineralization, by 6mpf. Histopathological examinations demonstrate significantly elevated levels of visceral and subcutaneous fat in the VDD fish compared to controls. Concordantly, gene expression data shows an overall upregulation of adipogenic and lipid processing markers in the liver of VDD fish. Hepatic triglycerides are significantly elevated in VDD fish; however, no significant differences are observed in cholesterol levels. One of our more interesting finds is that lipoprotein lipase activity and free fatty acid concentrations are down in the VDD plasma. Gross morphological assessments, including growth rate and feeding rate, alongside microCT analysis confirm decreased bone mineralization and stunted growth in the VDD fish. Targeted qPCR and global transcriptomics were employed to identify differentially expressed growth markers and lipid regulators that may be key linkages in the association between VDD and obesity. Taken together, our dietary model suggests that VDD results in stunted growth and central adiposity.

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Advisor: Walt Robinson
Poster Number: 116

How Future Climate Change Could Increase the Intensity of Heavy Rainfall in Central North Carolina

In recent years, heavy rains have caused considerable damage and injury to the citizens of Raleigh and surrounding cities. For example, heavy rains from an unorganized line of storms on July 16, 2016 closed roadways, flooded homes and vehicles, prompting multiple rescues, and caused hundreds of thousands of dollars in property damages. Notably flooding from nearby Crabtree Creek overwhelmed the parking garage of a shopping mall. Fortunately there were no causalities, considering that this occurred on a busy Saturday evening. Taking into account public safety and evidence that climate change amplifies heavy rainfall across the eastern U.S., it is worth investigating how these events could materialize in a warmer and more humid future. Climate modeling studies can help with these investigations, but such studies cannot reach robust and detailed conclusions, because the convective processes inherent to summer storms are not properly represented in global climate models. One way to circumvent this difficulty is to employ a high-resolution, convection-permitting weather model, specifically for the purpose of envisioning these storms realistically as they progress within the climates of today and of the future. We examine several local case studies, including the July 2016 Raleigh event described above. We simulate the storm in today's climate as a control. After analyzing the reliability of this simulation, we apply thermodynamic changes to the model's initial and boundary conditions and repeat the experiment. This is denoted the pseudo-global warming method. Thermodynamic changes are derived from climate model simulations of the late-21st century. Using the July 16, 2016 event, we show that future climate change leads to an intensification of rainfall over central North Carolina. We also test whether a similar result is obtained with another flood-producing storm, which occurred last year on the evening of August 19th.

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Advisor: Arnab Maity
Poster Number: 121

Robust Kernel Association Testing

When biologists sequence and collect data points (SNPs) on individuals' genes, a common question is whether those SNP-sets are significantly associated with a disease outcome. This hypothesis test may be difficult for two main reasons. Firstly, the set may be large with unknown interactions between individual SNPs, which makes it difficult to model parametrically. This first issue has been addressed through kernel machine regression methods, such as the sequence kernel association test (SKAT). These methods view the overall SNP-set effect as random, assume a normal response, and perform inference through mixed model methods and score tests. The second difficulty, which remains mostly unaddressed, is that the response is often skewed or heavy-tailed, violating the assumption of normality. We propose a general and robust kernel association test (RobKAT) with no distributional assumptions and previously established methods as special cases. RobKAT methodology builds upon previous methods by implementing a general loss function, which may be specified as the Huber loss function from robust statistics literature. We evaluate our proposed robust test across various data distributions through a simulation study. When the response is normally distributed, RobKAT performs with similar power and type I error control as normality-based testing methods. However, RobKAT is more powerful when the response is skewed, heavy-tailed, and bimodal. Applying our robust kernel association test on skewed data from the CATIE clinical trial, we detected four genes (HIST1H2BJ, MHC, POM121L2, and SLC17A1) that were significantly associated with herpesvirus antibody levels in schizophrenia patients. Three of these gene regions were undetected by standard kernel association testing methods, suggesting that RobKAT's power gains may translate to increased scientific findings.

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Graduate Program: Biology[1]; Smithsonian Institution[2]
Advisor: Ann H. Ross
Poster Number: 123

Interobserver Reliability of the Singh Index for the Assessment of Osteoporosis Using the Proximal Femur

For forensic practitioners, osteoporosis is critical to consider when interpreting trauma in human skeletal remains. In both clinical and forensic settings, assessing osteoporosis through bone mineral density and content measurements using a dual x-ray absorptiometry (DXA) on a Hologic® QDR Discovery 4500W scanner, has been shown to be the gold standard. Access to these types of machines to forensic practitioners is limited, however. An alternative approach is the method developed by Singh (1970) referred to as the Singh Index. The Singh Index uses a grading system, based on the trabecular bone pattern of the proximal femur, to assess osteoporosis. It uses a six grade scale, grade six reflecting normal bone and grade one reflecting severe osteoporosis. Due to its descriptive nature, the Singh Index is subject to error. The purpose of this study is to assess interobserver agreement of the Singh Index. The sample for this study involved 89 NC State undergraduate students with no radiograph experience enrolled in BIO240, spanning six sections who scored five radiographs in Google form. The radiographs were obtained from forensic cases housed at the NC Human Identification & Forensic Laboratory at NC State University for individuals ranging in age from 23-80 years in age. Fleiss' Kappa and Kendall's W were calculated in Microsoft Excel® to assess agreement between multiple observers scoring the radiographs. Kendall's W yielded a kappa value of 0.0141 with a *p*-value of 0.283. Fleiss' Kappa had a value of 0.0348 with a *p*-value of 0.00. The small kappa values indicate that there was little interobserver agreement between the undergraduate students across the five radiographs. This suggests that the Singh Index is not a reliable method to assess osteoporosis due to its low interobserver agreement. Further research will assess interobserver agreement in a sample of individuals with radiographic experience.

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Advisor: Reza A. Ghiladi
Poster Number: 128

Modulating Substrate Reactivity of Dehaloperoxidase Through Nonnative Cofactor Replacement

Metalloenzymes provide a useful platform to conduct specific chemical reactions with a high degree of chemoselectivity and catalyst turnover, while being economically and environmentally favorable when compared to traditional catalytic methods. To expand on native enzyme reactivity and functionality, incorporation of nonnative metal cofactors into metalloenzymes is a method that pushes the boundaries of protein engineering. An enzyme of interest to pursue nonnative cofactor incorporation is dehaloperoxidase (DHP), a globin isolated from the marine annelid Amphitrite ornata. The native enzyme is capable of oxidizing a wide range of substrates, encompassing halophenols, haloindoles, pyrroles, and haloguaiacols, by utilizing multiple substrate-directed oxidation mechanisms catalyzed by the cosubstrate, H_2O_2 or O_2. The versatility and robust nature of DHP provides an unprecedented multifunctional protein scaffold. By use of the Teale heme extraction method, the original iron-protoporphyrin IX (Fe-PPIX) was exchanged with M-PPIX (M = Mn, Co, Cu) or Fe-R-PIX (R = meso, deutero). UV-visible spectroscopic methods and X-ray crystallography determined that the nonnative porphyrins were successfully incorporated and retain the same position as the original cofactor. The reactivities of the modified enzymes were determined by using substrates with known reactivity with native DHP (indoles, phenols, and guaiacols) and quantified by biochemical assays monitored using UV-visible and liquid/gas chromatographic techniques. New enantiomeric oxidation activities of native DHP and its variants were also observed including the epoxidation of styrene derivatives, hydroxylation of sp3 C-H bonds (ethylbenzene, indane), sulfoxidation (thioanisole), and olefin cyclopropanation. By probing the reactivity of DHP and its cofactor variants we will provide insight on whether 'nature's selected' Fe-PPIX or the novel nonnative-DHP variants will lead to optimal reactivity and selectivity. The successful incorporation of nonnative cofactors into DHP and resulting enzymatic activity provides important understanding towards selectively tuning the enzymatic function of a unique multifunctional scaffold.

Erin M. Moore[1,2], Charles Wagner[2,3], Thirumurugan Rathinasabapathy[1,2], and Slavko Komarnytsky[1,2,3]
Graduate Programs: Food Science[1]; Plants for Human Health Institute, Kannapolis, NC[2]; Plant and Microbial Biology[3]
Advisor: Slavko Komarnytsky
Poster Number: 134

Combination of Spotted Wintergreen Lipids with Hemp Oil Improves Microbial and Immune Skin Health Outcomes

Mobile Discovery program provides a low-cost approach to explore chemical diversity of local ecosystems and discover its potential to improve human health. As a part of this program, we identified spotted wintergreen (*Chimaphila maculata*), a native Southern Appalachian plant of cultural significance to the Eastern Band of Cherokee people, as a botanical source of lipophilic bioactives (quinones, terpenes, phenolic glucosides) with potent antimicrobial and anti-inflammatory properties. Preclinical testing in skin and macrophage cell cultures showed high regenerative potential of spotted wintergreen preparations. When combined with hemp CBD oil (a distinctive source of essential fatty acids critical to support skin function and ß-oxidation), wintergreen lipid fraction increased migration and scratch wound closure in cell culture. Based on this data, we propose botanical-infused hemp oils as a novel group of topical skin care formulations potentially effective at alleviating cutaneous infections and disorders associated with abnormal skin regeneration.

Saed Pegahan, Jayampathi Kangara, and Ilya Arakelyan
Graduate Program: Physics
Advisor: John Thomas
Poster Number: 147

Spin-energy Correlation in Degenerate Weakly-interacting Fermi Gases

Very weakly interacting Fermi gases offer a new paradigm for exploring the interplay between spin, motion, Fermi statistics, and interactions in many-body systems, but have been relatively unexplored. In weakly interacting gases, coherence can be preserved over several seconds, enabling spin-energy correlations to develop. We study the formation of spin-energy correlations in a weakly interacting Fermi gas of 6Li contained in an optical trap with a spin-dependent potential. A tailored radio-frequency pulse creates an initial coherent superposition of two spin states with a controllable spin-energy spiral. We observe the subsequent evolution of the spin-up and spin-down density profiles over 1000 ms, demonstrating a long coherence time. Further, we precisely measure the magnetic field at which the s-wave scattering length vanishes (where spin segregation ceases) for both 1-2 and 2-3 hyperfine state mixtures, providing new constraints on the molecular potentials. Our work paves the way for beyond mean field studies, such as measurements of spatially correlated spin fluctuations.

Erin N. Peterson
Graduate Program: Genetics
Advisor: Reade B. Roberts
Poster Number: 150

Genomic Improvement and Structural Evolution of Sex Determination Loci in Rapidly Evolving Species

Sequenced genomes have been the key to unlocking the mystery of many genetic issues and questions. As cost continues to fall, more genomes are being sequenced, but many are left in draft forms. A model for genetic sex determination evolution, East African cichlid research has benefitted greatly by having the genomes of five species sequenced, representing species with several unique sex determination loci. While the East African cichlid group utilize multiple sex determiners, the question as to how and why multiple sex determiners evolved remains unsolved. We use a variety of strategies to understand evolution and developmental outcomes of sex determination in the cichlid species *Astatotilapia burtoni*. *A. burtoni* is a model organism for study of social and reproductive phenotypes, and three unique sex determining loci have been mapped in its genome thus far. Unfortunately, of the genomes produced, the *A. burtoni* genome was the most fragmented and remains in draft form while other genomes have undergone improvement by long-read technology and hybrid assembly strategies. To improve the *A. burtoni* genome, and also understand the structure of one of its sex determination chromosomes, PacBio long reads were sequenced from an individual *A. burtoni*. These reads are being used to scaffold and gap fill the contigs produced from the original draft genome. With a comparative approach also using the improved genomes of two other cichlids, *Metriaclima zebra* and *Oreochromis niloticus*, we examine how chromosome structure and mobile elements may have contributed to sex determination evolution. We hope to better understand genetic sex determination evolution among these closely related species by considering genomic rearrangements and structure in the sex determining loci.

Michael Pirhalla[1,2], David Heist[3], Steven Perry[3], Steven Hanna[4], Satya Pal S. Arya[1], and Viney P. Aneja[1]
Graduate Program: Marine, Earth, and Atmospheric Sciences[1], US Environmental Protection Agency, ORD/NHSRC/DCMD, Research Triangle Park, NC[2]; US Environmental Protection Agency, ORD/NERL/CED, Research Triangle Park, NC[3]; Hanna Consultants, Kennebunkport, ME[4]
Advisors: Viney Aneja and S. Pal Arya
Poster Number: 152

Analysis of the Jack Rabbit II Sonic Anemometer Dataset to Inform Boundary Layer Adjustments in Atmospheric Dispersion Models

Chemical, biological, radiological, or nuclear (CBRN) releases pose significant environmental and human exposure risks, especially in urban areas with high population densities. The complex nature of a cityscape brings substantial challenges when determining pollutant dispersal within the urban canopy because wind profiles become altered and turbulence is generated in street canyons and in wake of buildings. This can affect downwind and ground level concentrations after a hazardous release. To better understand complex flow conditions, the Department of Homeland Security (DHS) and Defense Threat Reduction Agency (DTRA) initiated a series of controlled field studies called Jack Rabbit II (JRII) in 2015 and 2016. Sequences of 10-20-ton releases of chlorine gas were dispersed within an array of CONEX shipping containers to mimic buildings or other roughness elements. Boundary layer wind flow characteristics were also collected using sonic anemometers, but the data have largely not been analyzed. The goal of this study is to present a preliminary analysis of the JRII wind flow dataset to inform urban adjustments in Gaussian dispersion models. Modifications to the local wind profile and turbulence terms could lead to improved boundary layer parameterizations in dispersion models, which are important for efficient and precise emergency preparation and response.

Sohini Raha
Graduate Program: Statistics
Advisor: Sujit Ghosh
Poster Number: 153

Heatwaves: Characterizations using Probabilistic Inference

Characterization of heatwaves is becoming increasingly important in environmental research as they pose a significant threat to many human lives worldwide. Though several quantifications of the extremities of a heatwave have been proposed in the literature, they are mostly improvised and there does not exist a universally accepted definition of heatwave. In this paper, we devise a probabilistic inferential framework to characterize heatwave, and come up with a definition which can capture the essence of all existing ad hoc definitions. We derive an exact distribution on the frequency of such durations for a stationary Markov process, and also an approximate distribution of durations for a stationary non-Markov time series. For a given site, using a daily time series (of ambient temperature or heat-index) we define a heatwave as the number of sustained days above a given threshold using the probability distribution of the durations. We illustrate the proposed methodology using daily time series of ambient temperature for a fixed site (of Atlanta) and also using the USCRN consisting of 126 sites across the U.S. Further we also derive an empirical quadratic curve based relationship between expected durations and extreme thresholds.

Kaylib R. Robinson and Jonathan J. Mills
Graduate Program: Chemistry
Advisor: Joshua G. Pierce
Poster Number: 158

The Lipoxazolidinones and Analogs as Leads for Novel Antibacterial Compounds

Natural products provide a privileged starting point for the development of novel compounds with clinically relevant biological activity, for example as antimicrobial agents. With the rapid increase and continued threat of multidrug resistant (MDR) bacteria, the need for new antimicrobial compounds with novel mechanisms of action is heightened tremendously as of late. The research presented herein focuses on the utilization of the lipoxazolidinone family of 4-oxazolidinone marine natural products as a starting point for the development of novel antimicrobial agents. Studies thus far have identified 4-oxazolidinone analogs that are effective against multidrug resistant bacteria including methicillin-resistant Staphylococcus aureus (MRSA). In addition, these compounds have been found to function as potent disruptors of bacterial biofilms. Studies are currently ongoing to elucidate the mechanism of action of these 4-oxazolidinone analogs, as well as develop analogs that inhibit Gram negative organisms in addition to their Gram positive counterparts. Overall, the lipoxazolidinones and their analogs present novel chemical structures that have potential as exciting lead compounds for antibiotic development and as probes to interrogate the microbial world.

Kylie D. Rock[1], Brian Horman[1], Allison L. Phillips[3], Matthew Ruis[4], Heather M. Stapleton[3,4], and Heather B. Patisaul[1,2]
Graduate Programs: Toxicology[1]; The Institute of Human Health and the Environment, Raleigh, NC[2]; Nicholas School of the Environment, Duke University, Durham, NC[3]; Toxicology and Environment Health, Duke University, Durham, NC[4]
Advisor: Heather B. Patisaul
Poster Number: 159

The Placenta as a Potential Target of Neuroendocrine Disruption: Effects of Brominated and Organophosphate Flame Retardants

Chemical flame retardants (FRs) are commonly applied to consumer products including foam-based furniture and infant products, textiles, and electronics. Widespread human exposure and accumulating evidence of endocrine disruption have raised concerns regarding the possible toxicity of these chemicals, particularly on the developing brain. Throughout gestation, the placenta is a critical coordinator of fetal growth and development, including neurodevelopment. We have shown in rats and humans that FRs accumulate in placental tissue; in some cases, to a greater degree in male-associated placentas than female-associated placentas. Given the important role the placenta plays in fetal programming, disruption of placental function may be a critical but underappreciated mechanism by which FRs induce changes, including sex-specific changes, in brain and behavior. Here we compare the gene expression profiles of male and female-associated placentas collected from Wistar rat dams gestationally exposed to one of three different FR mixtures. One consisted of a mixture of polybrominated diphenyl ethers (PBDEs), an important class of FRs that, although largely phased out, are strongly associated with behavioral and cognitive impairments in humans. The other two FR mixtures contained more recently introduced brominated and organophosphate ester (OPE) compounds. Using a combination of transcriptomic approaches, we identified several placental pathways related to neurodevelopment that were altered by FRs, including endocrine, inflammatory and neurotransmitter signaling pathways. Some of these mRNA expression changes were sex-specific, with upregulation of genes like *Esr1* and *Ar* present in female-associated placentas and *Tdo2* and *Htr2a* in male-associated placentas. Future work will continue to probe the hypothesis that sex-specific alterations in placental function could be a mechanism by which exposure to FRs alters neural development and behavior.

Hannah Noël Simmons[1], Amanda R. Hale[1], and Ann H. Ross[1,2]
Graduate Programs: Biology[1]; Smithsonian Institution[2]
Advisor: Ann H. Ross
Poster Number: 175

Carnivore Scavenging in the Southeast: Implications for Estimating Time-Since-Death

Scavenging of human remains has significant ramifications for forensic casework as it results in the loss of soft tissues, bone modifications, and scattering of remains prior to discovery. Carnivore scavenging can contribute to taphonomic bias via consumption and dispersal of human remains, which conflate accounts surrounding a decedent's death. Interpretation of these taphonomic changes is vital to the recovery of remains and for case resolution, particularly when perimortem trauma could be obscured by carnivore scavenging. Furthermore, interpretations of scavenging patterns can provide useful information regarding time-since-death and initial mode of deposition of remains. The existing model used to assess carnivore scavenging patterns was conducted in the Pacific Northwest and may not be appropriate in other geographic regions of the US, due to regional differences in species distribution. Thus, the purpose of this study was to examine if regional variation in canid scavenging existed through a retrospective study of 13 North Carolina forensic anthropological cases dating from 2006-2019. These cases were assessed for missing elements and taphonomic indicators of scavenging activity (e.g., tooth furrows, tooth pits). This retrospective survey suggests that the pattern observed in the Pacific Northwest differs from that observed in North Carolina, possibly reflecting different species distributions and densities. In addition, the original stages were developed from isolated cases observed in an area with a large wild canid concentration. When the progression pattern from the NC forensic cases was compared to the stages developed for the Pacific Northwest, there were notable differences, including limb disarticulation as the first stage in NC versus destruction of the thorax observed in the Pacific Northwest. An adapted canid six stage scavenging pattern is presented to assist with the estimation of time-since-death for North Carolina.

Aubree Szczepanski
Graduate Program: Marine, Earth, and Atmospheric Sciences
Advisor: Astrid Schnetzerl
Poster Number: 198

Impact of Copepod Grazing on Microplankton Assemblages in the Northwestern Gulf of Mexico

Copepods are the most numerous mesoplankton (200 – 2,000 µm in size) within the oceans, typically making up 70–90% of the assemblage. They are important grazers of microalgae and microzooplankton and in turn are important food for upper-level consumers (from fish to whales). What copepods feed on will strongly affect how much energy is shunted to the upper levels and therefore knowing under what conditions they make what food choices becomes important. Since these zooplankton have the ability to switch between prey types - a feature highly advantageous given the variability in oceanic food environments – characterizing food connections can be challenging. This study aims to characterize the impact of copepod grazing on coastal microplankton communities (~15–200 µm size fraction) in the Northwestern Gulf of Mexico near Galveston, Texas. Feeding experiments were conducted along an on-to offshore gradient, from highly productive nearshore to nutrient-limited offshore waters, during October 2017, January 2018 and March 2018. We determined copepod ingestion rate and the contributions from major taxonomic prey groups (e.g., diatoms, microzooplankton and others) to copepod diet using light microscopy. Preliminary data show how the impact of copepod feeding changes on overall prey abundances and diversity and how certain prey-predator relationships dominate carbon transfer along spatial and seasonal gradients.

Chelsea M. Taliaferro, Evgeny O. Danilov, and Felix N. Castellano
Graduate Program: Chemistry
Advisor: Felix N. Castellano
Poster Number: 188

Ultrafast Dynamics of Ir(III) Hydrides: Is Time-resolved Infrared Spectroscopy a Viable Technique for Monitoring M-H Stretching Modes?

Typically the center of photochemical reactivity, the metal hydride bond is instrumental in photocatalytic reactions involving transition metal hydrides. The ability to vary between photoacidic and photohydridic character is an extraordinary trait of some transition metal hydrides and allows for great tuning of photocatalytic behavior. However, this complicates the mechanistic study of these reactions. Time resolved spectroscopies allow for direct observation of photoproduct generation, therefore better elucidating the process(es) by which these reactions occur. However, very little photophysical characterization of these hydrides currently exists. To aid in the fundamental spectroscopic understanding of Ir(III) hydrides in particular, a robust Ir(III) dihydride was studied via ultrafast transient absorption techniques, revealing a short-lived metal-to-ligand charge transfer (MLCT) excited state without the generation of photoproducts. This enabled for direct interrogation of the Ir-H vibrational stretching modes using ultrafast transient infrared (TRIR) spectroscopy despite the low extinction coefficients of such vibrations. TRIR has been largely reserved for the study of metal-carbonyl and metal-cyano-containing compounds, based on the strong IR absorbance of these functional groups. This research introduces the possibility of obtaining time-resolved structural information of metal hydrides and in particular, their M-H bonds. The presented results will be compared to the spectroscopic behavior of more photoactive transition metal hydrides to probe the nature of M-H bond photocleavage.

Rebecca E. Venezia[1], Hans W. Paerl[2], Karen Rossignol[2], and Ryan W. Paerl[1]
Graduate Program: Marine, Earth, and Atmospheric Sciences[1]; Insititute of Marine Sciences, University of North Carolina Chapel Hill[2]
Advisor: Ryan W. Paerl
Poster Number: 192

Investigating Population Abundances and Morphotypes in the Picophytoplankton Community in the Neuse River Estuary (NRE)

Picophytoplankton (PicoP) are cells 0.2-3 µm in diameter possessing chlorophyll a and capable of carbon fixation via photosynthesis. Picophytoplankton significantly contribute to total phytoplankton biomass (~40%) and primary production (~50%) within the Neuse River Estuary (NRE) in summer/fall months. The types of picophytoplankton present in the NRE are not well resolved due to challenges of microscopy work; however, previous studies have found picocyanobacteria and picoeukaryotes to be present. The objective of this project is to characterize the picophytoplankton morphotypes present in the NRE in the summer and winter months, and see if these trends are similar to the trends found in the Chesapeake Bay. It is hypothesized that the green *Synechococcus*-like cyanobacteria morphotype is dominant in the summer months, when PicoP numbers are highest, and the red *Synechococcus*-like cyanobacteria morphotype is more dominant in the winter. PicoP morphotype abundance data will help improve understanding of the diversity in the picophytoplankton community and highlight abundant morphotypes for future study. Flow cytometry was used to distinguish distinct morphotypes within the picophytoplankton community based on the fluorescence of the photopigments (chlorophyll a, phycocyanin, phycoerythrin) and the size of the cells. Green (phycocyanin rich) *Synechococcus*-like cyanobacteria morphotype were found to be the dominant morphotype present in the summer months. Green *Synechococcus*-like cyanobacteria morphotype were found to be dominant in different regions of the NRE[MOU1]. The correlation between extracellular enzyme activity rates of enzymes in key processes (phosphatase, chitinase) and population abundances will be presented.

Samuel J. Widmayer[1] and David L. Aylor[1,2,3]
Graduate Program: Genetics[1]; Bioinformatics[2]; Toxicology[3]
Advisor: David L. Aylor
Poster Number: 200

Genomic Signatures of Hybrid Male Sterility in the Mouse

Hybrid male sterility (HMS) is a reproductive barrier that restricts gene flow between two subspecies of mice, *Mus musculus musculus* and *M. m. domesticus*. Two major loci have been previously linked to HMS in laboratory crosses, but we observed wide variation in fertility and reproductive traits among hybrids with identical genotypes at those loci. We characterized reproductive trait variation in a panel of hybrid males bred by crossing musculus-dervied PWK/PhJ females to males from four inbred mouse strains of primarily domesticus origin. These hybrids displayed three distinct trajectories of fertility: complete sterility, complete fertility, and age-dependent fertility. Males that displayed age-dependent fertility were only fertile between 15-35 weeks of age with moderate penetrance. These results point to multiple segregating HMS modifier alleles, some of which have an age-dependent mode of action. We identified several candidate loci that may harbor HMS modifiers by comparing local patterns of subspecies ancestry sharing across the genomes of these strains. Whole-testis gene expression patterns distinguished the three fertility trajectories and implicated impaired regulation of key meiotic processes in HMS. These results support a polygenic basis of HMS with distinct regulatory signatures within the testis.

Jaime A. Willett[1,2,3], Ashlyn Johnson[1], Opal Patel[1], David M. Dorris[1], and John Meitzen[1,2,4]
Graduate Program: Physiology[1]; W.M. Keck Center for Behavioral Biology[2]; Physiology[3]; Center for Human Health and the Environment, Center for Comparative Medicine and Translational Research[4]
Advisor: John Meitzen
Poster Number: 201

The Estrous Cycle Modulates Rat Caudate-Putamen Medium Spiny Neuron Physiology

The neuroendocrine environment in which the brain operates is both dynamic and differs by sex. How this unstable neuroendocrine state affects neuron properties has been significantly neglected in neuroscience research. Behavioral data across humans and rodents indicate that natural changes in steroid sex hormone production affect sensorimotor and cognitive function in both normal and pathological contexts. These behaviors are critically mediated by the caudate-putamen: a well-conserved constituent of the basal ganglia that is instrumental for forebrain function, various forms of learning, and sensorimotor performance. In the caudate-putamen, medium spiny neurons (MSNs) are the predominant and output neurons. Thus, MSNs are fundamental components of the circuits which underlie striatal-mediated behaviors. MSNs express membrane-associated estrogen receptors and demonstrate estrogen sensitivity. However, the effects of cyclical hormone changes across the estrous cycle on caudate-putamen MSN electrophysiological properties has not been investigated. To test this hypothesis, we performed whole-cell patch clamp recordings on male, diestrus female, proestrus female, and estrus female caudate-putamen MSNs. Action potential, passive membrane, and miniature excitatory postsynaptic current properties were assessed. Numerous MSN electrical properties robustly differed by cycle state, including resting membrane potential, rheobase, action potential threshold, maximum evoked action potential firing rate, and inward rectification. Strikingly, when considered independent of estrous cycle phase, all but one of these properties do not significantly differ from male MSNs. These data indicate that female caudate-putamen MSNs are sensitive to the estrous cycle, and more broadly, the importance of considering neuroendocrine state in studies of neuron physiology.

Wilson College of Textiles

Ciera E. Cipriani[1], Erol Yildirim[2], Cody P. Zane[3], Melissa A. Pasquinelli[1,3], and Nelson R. Vinueza[1,3]
Graduate Program: Textile Chemistry[1]; Institute of High Performance Computing, Agency for Science, Technology and Research, Singapore[2]; Fiber and Polymer Science[3]
Advisors: Nelson R. Vinueza and Melissa A. Pasquinelli
Poster Number: 34

Effect of Structure and Isomerization on the Photodegradation of Disperse Dyes: A Combined Theoretical and Experimental Study

Azo compounds, which possess the structure R-N=N-R', are commonly used as dyes in the textile industry. Previous studies indicated that azo dyes generally break down at their azo bonds by photodegradation, which can form toxic aromatic compounds. However, Li and co-authors recently observed the photodegradation products of Disperse Red 1 (DR1) to correlate with the breakdown of its substituent groups. We investigated the photodegradation mechanisms of five disperse dyes using density functional theory (DFT) calculations. For both the ground and excited states, we explored the cis-to-trans transition and observed that the trans isomers were generally most susceptible to radical attack at their amino end groups, while the cis isomers were more reactive at their azo bonds. We also dyed poly(ethylene terephthalate) fabrics with DR1 and photodegraded them for different time intervals, and then analyzed them using high resolution tandem mass spectrometry (MS) to elucidate a general photodegradation pathway for DR1. We determined that the major photodegradation products were not based on the azo bond cleaving, but rather breakage within the arylamine group. These measurements, in conjunction with our DFT calculations, revealed that the main factors that change the reactivity of the azo center, ethyl and hydroxyethyl groups were the molecular structure of the terminal groups and pendant side chains, reduction of the azo bonds, and molecular conformation about the azo bond. The molecular structure of azo dyes may allow for control of the location and mechanism of photodegradation, so that fewer harmful aromatic compounds are released into the environment.

Hannah Dedmon
Graduate Program: Textile Engineering
Advisors: Ericka Ford
Poster Number: 45

Evidence of Antiplasticization Effect on Vinyl Polymer Systems for High Performance Use

Good mechanical properties and high thermal stability of poly(acrylonitrile) (PAN) makes it a popular polymer for producing a large variety of textile products, namely high tenacity, high modulus fibers i.e. carbon precursor. However, the unique structure and high polarity of PAN's chemistry prevents it from being melt processed, with a melting temperature above its degradation temperature. To create fiber, PAN is solution spun at increased cost with the addition of stabilizers, a trade secret. To create a cost effective precursor and to answer industry's call for sustainable carbon fiber, current thesis research aims to understand the effect of low molecular weight additives, antiplasticizers, on the mechanics of gel spun vinyl polymers for high performance use. Most interesting among these were diacid isomers. Using Molecular Dynamics (MD) simulations to assess the strength of antiplasticization and predict dope properties, several spinning trials were carried out experimentally. Biomass additives contributed to improved processability, improved modulus and strength, higher structural order and increase in crystalline relaxation temperature. Spinning mechanics were also studied, focusing on increasing jet stretch ratio and improving extensional viscosity.

Benjamin Gillespie
Graduate Program: Textile Engineering
Advisor: Jesse S. Jur
Poster Number: 60

Integrating Commercially Available Energy Storage into a Textile Garment

Energy storage in garment-based wearable technology systems has been a primary challenge preventing the field from becoming a widely used technology. Today, wearable electronics utilize energy storage systems that are bulky and that must be removed from the garment before wash and dry cycles. This process of removal provides the user with enough change from their everyday laundry process that it becomes undesirable. Ideally, energy storage would be seamlessly integrated into a garment so as to provide the user without a burdened experience and allow for long term use. This project aims at fully integrating energy storage into the garment so that the wearer doesn't need to change their behavior to experience the benefits that wearable technology provides. To do this, we conducted a system design analysis for electronic and LED integration via a fiber optic cable along with a rechargeable thin film battery into a Champion hoodie. A circuit with integrated energy storage was developed and each electrical component was examined for durability and functionality. This is the first fully washable and integrated e-textiles garment. Toward the product development, multiple strategies for integration were explored and ranked. During this process, a supply chain was established that included validation of technologies from multiple vendors and manufacturers. Manufacturing strategies and methods were also established as a primary guide to aid in cost analysis and reduction.

Juechen He
Graduate Program: Textile Technology Management
Advisor: Emiel DenHartog
Poster Number: 74

A New Method to Capture the Dynamic Liquid Transport on Fabrics Using a Sweating Guarded Hot Plate and Thermal Imaging Camera

Liquid transport on fabrics is essential to wear comfort. When humans sweat, an ideal fabric should have the ability to transport liquid from the skin surface quickly and to dry fast to minimize the discomfort sensation caused by sweat while optimizing cooling. The way the liquid interacts with the fabric and the skin can affect wearer's thermal and tactile wet comfort. In this study, a new method to capture the dynamic liquid transport process on fabrics was developed. A sweating guarded hot plate was used to provide a steady liquid and heat source to the fabrics and to measure the total heat loss. During the test, the fabric sample was placed on the heated plate (35°) and a total of 0.8 ml distilled water was supplied to the fabric sample (10 x 10 cm) through four sweat pores of the plate. A thermal imaging camera and a cell phone camera were set on top of the fabrics to simultaneously record the dynamic wetting and drying process. The corresponding thermal and regular video indicated that there are different liquid spreading and drying patterns among different fabrics. By analyzing the corresponding videos, a sticking effect was identified between the wetted fabrics and the heated plate in some wool and polyester knitted fabrics. The maximum wetted area of each fabric was identified by utilizing ImageJ software. The development of this method provided a new way to capture the dynamic liquid transport process on fabrics and is helpful in characterizing wetting and drying properties of textile materials for assessing wet thermal and tactile comfort on the skin. Furthermore, the method provides better insight in the determining factors of comfort of wet fabrics on the skin.

Javier Jimenez
Graduate Program: Textile Chemistry
Advisor: Ericka Ford
Poster Number: 86

Radical Polymerization of Lignin Materials

Lignin has been mass produced in the paper and pulp industry with about 50 million tons produced in 2013. However, of the 50 million tons, only 2% was further refined for commercial use whereas the remaining 98% was burned as low-value fuel. Ultimately, this untapped biomaterial can be used in polymeric blends with petroleum-derived synthetics to decrease costs and increase the environmental sustainability of the finished products. However, within the use of lignin, there have been notable problems in its processibility, which are attributed to its low molecular weight and structural irregularities. Depending on the process of extraction, lignin types can have different chemical structures. These differences can affect the build-up of molecular weight and their rheology post polymerization. Both Kraft lignin and acid-hydrolyzed lignin were used to investigate the effect of –ene group (C=C) concentration on the polymerization of each lignin type. Solution viscosities of Kraft lignin dissolved in dimethyl sulfoxide (DMSO) increased as the weight percentage of free radical initiator reached 20% of lignin. An elastic, DMSO insoluble polymer formed once initiator concentration reached 50% of lignin. Further viscosity did not increase with initiator concentration for reactions involving acid-hydrolyzed lignin.

Hey-sang Kim[1], Stephen Michielsen[1], Emiel A. DenHartog[1], and Chau-Wai Wong[2]
Graduate Programs: Fiber and Polymer Science[1]; Electrical and Computer Engineering[2]
Advisors: Stephen Michielsen and Emiel DenHartog
Poster Number: 98

Capillary Phenomena in Textiles with Continuous Microfluidic Flow

Wicking phenomena in fabrics is driven by capillary action, which is affected by the fiber parameters, yarn structures and liquid properties. By developing a better wicking performance fabric, we can improve physiological comfort by removing liquid away from sweating source through capillary channel as well as faster evaporation. Even though the liquid transport in the void space between fibers within a yarn (or between yarns) is known as the most critical phenomenon in fabric wicking, typical wicking test methods, such as vertical wicking test and gravimetric absorbency testing, could not explain how yarn-level wicking plays a role within the fabric. For this reason, we developed a new method called 'Single Point Source Wicking within Fabric' to investigate how liquid transports in fabric based on within-yarn and yarn-transfer wicking. This single point source wicking test was conducted by supplying continuous liquid flow to a single yarn within the fabric. In order to mimic sweating phenomenon, this single point source method avoided the flooding liquid stage by controlling flow rate and choosing a similar diameter of liquid source to sweat gland pore size. By controlling liquid flow rate, we evaluated wicking phenomena of fabrics with image analysis for quantitative measurement. We have successfully measured directional wicking rates and individual yarn wicking performance, which has not yet been explained in this area. A better understanding of wicking performance with this single point source method promises to provide a predictive model of wicking performance fabrics and should result in a large contribution to textile industry including sportswear, military apparel and textile printing.
*This project was funded by Eastman Chemical Company.

Hanna Lee
Graduate Program: Textile Technology Management
Advisor: Yingjiao Xu
Poster Number: 110

Fashion Consumers' Adoption of Virtual Fitting Rooms (VFRs): A Perspective of Motivations and Perceptions

Consumers today show tremendous demands toward fitting experiences even in the online shopping channel. Virtual fitting room (VFR) is a simulation technology that enables consumers to browse broader collections and virtually try on inventories even with online channels. By translating the in-store fitting experiences to the online space with the use of sophisticated sensory elements, VFRs provide consumers with additional affective experiences as well as opportunities to fulfill their functional fitting needs. However, while a variety of VFR technologies are available in the marketplace, the adoption of VFRs is still at the early stage with much to explore in terms of consumer adoption behaviors. Therefore, the purpose of this study was investigate consumers' behavior toward VFRs from the perspectives of motivations and perceptions. Specifically, the study aimed to determine the effect of consumers' distinct motivations on their perception of the experiential and functional aspects of VFRs, and subsequently on their intention to adopt VFRs. Additionally, the moderating effect of fashion leadership was also examined. Data were collected from 340 Korean consumers via an online survey and analyzed using structural equation modeling as well as multi-group comparisons. The results revealed that distinct motivations exerted significant influences on consumers' perceptions of VFRs. In turn, consumers' positive perceptions of the experiential and functional attributes of VFRS had a positive effect on their adoption intention. Additionally, results of the study also suggest that consumers' fashion leadership moderated the importance of rendering experiential and functional features of VFRs in increasing consumer adoption of VFRs.

Braden M. Li, Inhwan Kim, and Jesse Jur
Graduate Program: Fiber and Polymer Science
Advisor: Jesse Jur
Poster Number: 112

Kirigami Design Considerations for Enhancing the Electro-Mechanical Performance of Printed E-Textiles

One of the fundamental challenges in the electronic textile (e-textile) industry is the mismatch in compliance between the rigid electronic components integrated onto soft textile platforms. To address these problems, various printing technologies using conductive inks have been explored in an effort to improve the electromechanical performance without sacrificing the innate properties of the printed textile. However, current printing methods deposit thick layered coatings onto textile surfaces with low through-plane wetting resulting in poor electromechanical properties. This work presents a novel inkjet printing technique in conjunction with unique Kirigami cut designs to address these issues for printed smart textiles. By utilizing particle free reactive silver inks our inkjet process produces conformal and micron thick silver coatings that surround individual fibers of the printed smart textile. This results in a highly conductive (0.63 W / sq^{-1}) printed e-textile while also maintaining the innate properties of the textile material including stretchability, flexibility, breathability and fabric hand. Kirigami is the Japanese art of paper cutting. By utilizing periodic cut designs, Kirigami imparts enhanced flexibility and delocalization of stress concentrations. Kirigami cut design parameters (i.e. cut spacing and length) were correlated to both the mechanical and electromechanical properties of the printed textiles. We demonstrate that designs using a higher cut-out ratio exponentially softens the textile substrate. Thus, our designs achieve a 30x improvement in the overall stretchability, 1000x decrease in elastic modulus, and minimal resistance change over strain regimes of 100-200% when compared to uncut designs. We also show minimal resistance change of our Kirigami inspired printed devices after being stretched to 100% for 1000 cycles. Lastly we demonstrate a Kirigami-inspired electrocardiogram (ECG) monitoring system that improves stretchability without sacrificing signal acquisition performance. Overall this study suggests fundamental parameters affecting the performance of e-textiles and their scalability in the wearable technology industry.

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Poster Number: 170

Strategies to Improve the Unconfined Melt Electrospinning Process via Incorporation of Ionically Conductive Particles

By utilizing a sharp-edged flat plate, multiple parallel jets can be electrospun spontaneously from unconfined polymer melts. In this work polyethylene was electrospun from a thin film of the polymer melt heated on an electrically-grounded flat plate to a negatively charged collector. This technique can produce fibers with a throughput rate of about 50 mg. without the possibility of clogging which frequently happens in traditional single needle electrospinning due to high viscosity of polymer melts. The effect of increased melt conductivity through salt additives on fiber diameter was studied to present a method for fabrication of smaller diameter fibers from highly-insulating polymer thermoplastics in melt electrospininng. Also, the environmental temperature, specifically in the spin-line shows to have a significant impact on the fiber diameter and the spinning process. Support received from the National Science Foundation.

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Poster Number: 172

Analysis of Fireground Contamination of Firefighter Personal Protective Equipment

Firefighters are at a 1.2-2 times greater risk of contracting certain types of cancer as compared to the general population. After preliminary research on used firefighter turnout gear, it was evident that contaminated turnout gear and ensemble elements could be linked to heightened cancer rates amongst firefighters. Compounds such as polycyclic aromatic hydrocarbons (PAH's), perfluorinated compounds (PFC's), phenols, phthalates, brominated flame retardants, dioxins, volatile organic compounds (VOC's), of which many are known carcinogens, get adsorbed onto the surface of contaminated gear and present an exposure hazard to firefighters. For this research, extraction and analysis methods for the compounds of interest were first developed to ensure efficient removal of contaminants. In the process, common fabrics used in firefighter turnout gear were contaminated using a controlled reference standard mix of phenols and phthalates, the fabrics were sonicated to facilitate contaminant extraction using a suitable solvent, and gas chromatography (GC) was used to identify and quantitate individual components in the toxic sample mixture. The extraction efficiencies and limits of detection and quantitation (LOD, LOQ) were calculated based on the extracted analytes. After experiments with fabric extractions, it was found that most of the materials used in the gear inherently contain significant amounts of phthalates and some contain phenols as well, which may impact future analyses of real world samples. The final part of the research will be to use the validated methods to identify and extract chemicals from actual firefighting turnout gear, which will prove to be landmark research in reduction of cancer rates among firefighters across the world.

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Poster Number: 186

Novel Textile and Polymer-based Sensors for Prosthetic Environment Monitoring

Amputees are often uncomfortable when wearing their prosthetic devices. While wearing a prosthetic device, an amputee's residual limb may be exposed to elevated levels of pressure, temperature, and humidity. In this uncomfortable as well as unhealthy environment, the residual limb may form ulcers and sores or an amputee may alter their natural gait leading to chronic pain. Ultimately, the discomfort may be so severe an amputee can no longer wear their prosthetic limb. To better understand the inner socket environment or the region between the residual limb and the prosthetic socket, researchers often employ rigid off-the-shelf sensors. While these sensors do provide some measure of the inner prosthetic environment, such devices are often inflexible, bulky, and overall uncomfortable for the amputee. In this research, two distinct, flexible, textile and polymer-based sensors are explored for monitoring the complex inner prosthetic environment. First, a uniquely shaped fiber has been developed which is capable of monitoring several parameters when woven into a fabric configuration. The novel fiber is produced in a commercial tri-component melt extrusion process. A second sensing approach utilizes conductive yarns and a standard sewing process to create fabric sensors. Fabrication of these sensors is simple and provides means to create large, customizable sensor arrays for this and many other applications. Ultimately, the developed sensors will be used to better understand the inner prosthetic environment such that amputee quality of life may be improved.

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Poster Number: 204

Garnet-rich Composite Solid Electrolytes for Dendrite-free, High-rate, Solid-state Lithium-metal Batteries

As compared to flammable liquid electrolytes, composite solid electrolytes (CSEs), which are composed of inorganic fillers and organic polymers, show improved safety and suppressed Li-dendrite growth in Li-metal batteries. However, the performance of current CSEs is limited by low content of inorganic Li+-conducting fillers and ineffective Li+ transport between the inorganic fillers and the polymer matrix. To address these challenges, we have developed a new type of CSEs composed of silane-modified Li6.28La3Al0.24Zr2O12 (s@LLAZO) nanofibers and poly(ethylene glycol) diacrylate (PEGDA). In this type of CSE, silane is employed as a coupling agent, in which one end of silane molecule is covalently bonded to the surface of LLZAO, and another end is grafted with the monomers of polymer matrix. Employment of the silane coupling agent enables the incorporation of a high content of LLAZO (up to 60 wt%) nanofibers with the polymer matrix and results in a well-percolated three-dimensional LLAZO network with fully embedded in the PEGDA matrix. As a result, the silane coupling agent successfully eliminated the agglomeration effect, which ensures the higher ionic conductivity, larger lithium transference number, wider electrochemical stability window and better cycling stability for s@LLZAO-PEGDA CSEs. Such a CSE is then used to assemble the all-solid-state Li/LiFePO4 cells, which demonstrate the discharge capacities of 147 and 78 mAh g-1 at a rate of 0.5 and 5 C, respectively, and excellent cycling stability at 0.5 C with extraordinarily high rate capability up to 10 C at ambient temperature. In short, the novel design of CSEs with s@LLAZO nanofibers opens an alternative avenue for the acceleration of all-solid-state Li-metal batteries.

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Poster Number: 209

Designing an Antimicrobial Knitted Wound Dressing for Vacuum Assisted Wound Closure

Open wounds such as venous ulcers, burn injuries, exposed joints and skin graft donor sites require wound dressings that protect the wound from blood loss, infection and further trauma, and may also promote wound healing. Previously, on account of its high flexibility and its ability to cause blood coagulation, we have promoted the use of a 3D spacer fabric knitted from polyester (PET) yarns to serve as a dressing for vacuum assisted wound closure (VAC) therapy. However, the addition of an antimicrobial finish enhances the prevention and management of wound infections compared to regular materials like polyester. Generally, an antimicrobial function of the fiber's surface can be achieved by applying an appropriate chemical treatment like chitosan. The primary purpose of this study was to evaluate the mechanical properties and the anti-bacterial performance of chitosan–coated polyester knitted 3D spacer fabric. Chitosan was obtained from Dungeness Environmental, Everett, WA. It was 95.3% deacetylated and had a number average molecular weight of 740,000 (740 kDal). The basic nylon yarn was a 100 denier, 34 filament yarn, from Unifi Inc. Greensboro, NC. It was used to knit a 3-dimensional spacer fabric on a Ruis warp knitting machine with 2 needle beds and 4 guide bars. Chitosan was dissolved in 5% acetic acid to prepare a 3% solution by weight. The procedure of surface modification was achieved by treating the nylon spacer fabric with a radio frequency plasma (94.6% helium and 5.4% oxygen) and then placing it in the chitosan solution. The mechanical, moisture management and antimicrobial property of the existing and proposed wound dressing materials were measured and compared, including the tensile strength and flexural rigidity, liquid absorption rate and liquid retention capacity and antimicrobial performance. The spacer fabrics knitted from chitosan-coated nylon 66 yarn have similar mechanical properties to those fabrics without the coating. Gram positive and Gram negative staining was applied to check the antimicrobial efficacy of the samples over time. It was observed that the effectiveness of the anti- bacterial performance of spacer fabric was strongly dependent on the stability and durability of the chitosan surface coating.

College of Veterinary Medicine

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Poster Number: 5

Establishing the Pig as an Animal Model for *Chlamydia trachomatis* Vaccine Development

Chlamydia trachomatis (Ct) is the most prevalent bacterial sexually transmitted diseases in the world. Infections in women can lead to infertility, chronic pelvic pain and ectopic pregnancy. Nevertheless, a vaccine is currently not available partly due to the lack of appropriate animal models. The pig is a valuable animal model for vaccine development, is susceptive to Ct, and is the natural host to *Chlamydia suis* (Cs), which is closely related to Ct. In addition, pigs accurately resemble human Ct infection and immunity. The objective of the present study was to show the value of the pig for Ct vaccine development. 24 pigs were divided into 4 groups. Pigs received 2 intranasal vaccinations at days 0 and 14 with MOCK (groups A and B), UV-inactivated Cs (group C) or UV-inactivated Cs+TriAdj adjuvant (group D). At day 28, pigs were challenged intrauterine with MOCK (group A) or Cs (groups B-D). Blood and vaginal swabs were collected pre- and post-vaccination, and at 0-7, 14, and 21-days post-inoculation (dpi). Ct infection was monitored by vaginal swabs via qPCR while the immune response was determined by *in vitro* re-stimulation of PBMC with Cs lysate and multi-color flow cytometry to detect Cs-specific T-cell subsets. All but one challenged animal developed Cs infection with yellow vaginal discharge in 8/18 infected animals. Cs stimulated several T-cell subsets and T-helper cells are the main responders. Cs induces mainly central memory T cells and stimulated production of mainly IFN-γ and IL-2 in proliferating $CD4^+$ T cells. Detection of pathogen-specific memory T cells combined with qPCR determination of the pathogen load can be used to determine vaccine immunogenicity and its impact on chlamydial burden in pigs. These data combined with the biological relevance of swine indicate a great potential for the use of this large animal model for Ct vaccine development.

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Poster Number: 40

Increased Intestinal Epithelial Permeability with Doxorubicin Administration

Doxorubicin (DXR), a DNA damaging chemotherapeutic, has been shown to cause gastrointestinal damage as a side effect of administration. DXR administration leads to increased apoptotic cells, increased chemokines, and macrophage infiltration in mouse jejunum. We hypothesize that DXR increases epithelial barrier permeability resulting in proinflammatory signaling and immune cell recruitment. C57/B6J mice were used to assess *in vivo* barrier function. Mice were administered 20 mg/kg of DXR via intraperitoneal injection and jejunal tissue was isolated 24 hours later. Ussing Chambers were utilized to assess *ex vivo* transepithelial resistance (TER) of jejenunal tissue of control and DXR treated mice. TER was significantly reduced in DXR treated mice 24 hours after administration compared to control tissues. To further assess this loss of TER, T84 cells, a colorectal carcinoma cell line, were grown as monolayers on transwells to model the intestinal epithelial lining. To test the permeability of this monolayer, cells were exposed to DXR and TER was assessed. TER was lower 24 hours post DXR. This drop in TER suggested that an increase in macromolecular flux was occurring. T84 cells were then apically exposed to FITC-dextrans of varying sizes to assess flux of different molecular weight molecules across the barrier. After 24 hours of exposure to DXR, there was a significant increase in the flux of each FITC-dextran across the monolayer. These data suggest that bacterial products may be able to transit the intestinal epithelium after DXR exposure *in vivo* and that tight junctional complexes may also be affected by DXR exposure as well. Assessment of tight junctional gene expression after DXR exposure suggest that barrier function is impeded both *in vitro* and *in vivo*. Together, the loss of TER and the FITC-dextran permeability data suggest that bacterial products may be able to transit the intestinal epithelial barrier.

Ke Huang
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Advisor: Ke Chang
Poster Number: 79

Bispecific Antibody Therapy for Effective Cardiac Repair Through Redirection of Endogenous Stem Cells

Bone marrow stem cells (BMSCs), are a promising strategy for cardiac regenerative therapy for myocardial infarction (MI). However, cell transplantation has to overcome a number of hurdles, such as cell quality control, clinical practicality, low cell retention/engraftment, and immune reactions when allogeneic cells are used. Bispecific antibodies (BsAbs) have been developed as potential agents in cancer immunotherapy but their application is sparse in cardiovascular diseases. In the present study, BsAbs are designed by chemical cycloaddition of $F(ab')_2$ fragments from monoclonal anti-CD34 and anti- cardiac myosin heavy chain (CMHC) antibodies, which specifically targets circulating CD34-positive cells and injured cardiomyocytes simultaneously. We hypothesized that intravenous administration of stem cell re-directing (SCRD) BsAbs (anti-CD34-$F(ab')_2$--anti-CMHC-$F(ab')_2$) can home endogenous BMSCs to the injured heart for cardiac repair. Our *in vivo* studies in a mouse model with heart ischemia/reperfusion (I/R) injury demonstrated the safety and therapeutic potency of SCRD BsAb, which supports cardiac recovery by reducing scarring, promoting angiomyogenesis, and boosting cardiac function.

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Poster Number: 97

Improved Evaluation of Vaccine- and Infection-induced Immunological Memory to Porcine Reproductive and Respiratory Syndrome Virus (PRRSV)

Developing a vaccine protecting against heterologous Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) strains remains a critical objective for the pork industry worldwide. The efficacy of a PRRSV vaccine depends on whether it induces immunological memory towards the various circulating PRRSV strains (heterologous protection). Current in-vitro vaccine evaluation methods do not adequately determine induction of immunological memory. The objective of this study was to develop a system to precisely evaluate vaccine- and infection-induced immunological memory to homologous and heterologous PRRSV strains. Four-week old PRRSV naïve piglets were divided into four groups: MOCK, Modified Live Virus (MLV) vaccinated, or infected with a Low Path (LP) and High Path (HP) strain. Blood was collected over nine weeks to study humoral and cell-mediated immune responses to homologous and heterologous PRRSV strains. PRRSV inoculation resulted in viremia in infected and vaccinated animals and moderate clinical symptoms in LP and HP treatments. For humoral immunity, PRRSV infected animals produced homologous neutralizing antibodies (nAb) by 14 days post infection (dpi), while nAb in MLV treatment lagged infected animals through 63 dpi. Heterologous nAb reactivity occurred between HP and LP treatments but not with MLV treatment or virus. For cell-mediated immunity in PBMCs, PRRSV-specific TCR-aß subsets in PBMCs responded most strongly at 28 dpi to homologous viral restimulation for HP and MLV treatments and 42 dpi for LP treatment. MLV, LP, and HP treatments displayed cross-reactivity upon heterologous restimulation to a varying degree. Lymph node isolated T-cells displayed a similar pattern of homologous and heterologous response as PBMCs. This study provides a novel analysis system to evaluate the porcine immunological memory response to homologous and heterologous PRRSV strains. Future studies will investigate the specific characteristics of immunological memory that result in protection from PRRSV to improve vaccine evaluation.

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Poster Number: 106

Associations Between Ecological and Socioeconomic Factors and *Bartonella henselae* Exposure in Dogs in North Carolina

Bartonella henselae is a zoonotic vector-borne pathogen affecting both humans and dogs. Little is known about the epidemiology of *B. henselae* in dogs, including risk factors associated with exposure. The objectives of this study were to map the current distribution of *B. henselae* in dogs in North Carolina and to identify ecological and socioeconomic factors influencing *B. henselae* seroreactivity. The hypothesis was that risk factors previously associated with tick-borne diseases of dogs, including climatic conditions as well as geographical and societal factors will also be associated with *B. henselae* exposure in dogs. Results from 4,446 *B. henselae* diagnostic serology samples from dogs in North Carolina submitted to the North Carolina State University College of Veterinary Medicine Vector Borne Disease Diagnostic Laboratory between January 1, 2004 and December 31, 2015 were used to generate a map of *B. henselae* seroreactivity. To account for sparsely sampled areas, statistical smoothing using head-banging and areal interpolation kriging was performed. Using previously described risk factors for exposure to canine tick-borne diseases, eight multivariable logistic regression models based on biologically plausible hypotheses were tested, and a final model was selected using an AIC weighted-average approach. Seroreactivity amongst tested dogs was variable across the state: higher along the southern/eastern coastal plains and eastern Piedmont, and lower in the western mountains. Of 25 explanatory factors considered, the model combining demographic, socioeconomic, climatic, and land use variables fit best. Based on this model, female intact sex and increasing percentage of the county with low-intensity development and evergreen forest were associated with higher seroreactivity. Conversely, moderate development, increasing median household income, and higher temperature range and relative humidity were associated with lower seroreactivity. However, the model only explained a small portion of the variability in *B. henselae* seroreactivity, suggesting that local and host-scale factors not included in this model may play a significant role in dogs' exposure.

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Poster Number: 21

The Retail Horoscope: The Study of How Macro and Micro Trends Will Impact the Retail Business of Tomorrow

The retail environment is considered a sanctuary for many. Within these shopping parameters, it is known to satisfy demands, fulfill dreams, and create passionate desires. Over the past few decades, the expectations of shopping have evolved. In previous times, buying product was the fulfillment of consumers, whereas of now, it is vital to generate new outlooks and implement new strategies that will help drive business and keep consumers intrigued. In today's market, we are encountering new ways of attracting consumers, but most importantly the millennial market. For most retailers, the challenge that lies ahead consist of keeping the attention of this particular consumer group. The objective of this study is to analyze the retail environment of today, and observe how macro and micro trends are effecting the retailer's strategies, ideologies and practices of tomorrow; while engaging with the millennial consumer. Conventional practices and rehearsed greetings have become weaken and are now being replaced by innovative experiences and guerilla marketing. This study has been carried out by two research methods: A qualitative interview proposed to eight industry professionals in conjunction with a quantitative method serving 100 diverse participants with a survey questionnaire. Both research methods conveyed imperative results that concluded the same substantial idea of implementing more customer centric strategies, digitalization into the retail environment, and focusing on the creation of memorable experiences for the consumer. Research concludes that the market is transitioning into a new direction that is driven by anxious consumers, but are implemented by scruple retailers.

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Poster Number: 85

Luxury/Mass-Market Co-Branding: A Study on Luxury Fashion Brand Collaborations with Mass-Market Retailers

In recent years, collaborations between brands across hospitality, transportation, and product segments have been an increasingly popular and effective venture. The luxury industry is a trillion industry, with the personal sector accounting for $300 billion. The rise in frequency within such a lucrative sector brings forth the question of the value such collaborations add to the marketplace. In the fashion industry, collaborations between luxury brands and mass-market companies are becoming a powerful and prevalent tactic to grasp consumer attention. However, most of the research on these collaborations revolves around consumer opinions of brand collaborations instead of company-controlled factors. Focusing on the fashion industry, this thesis is a comprehensive evaluation of the collaborations between luxury designer brands and mass-market retailers. This thesis researches brand image, media activity, and launch activity of seven luxury designer brand collaborations with Target and H&M from 2009-2015. The goal of the research is to obtain a greater insight into the reactions, consequences, and value of such collaborations. This study utilizes a qualitative research method in the form of netnography and content analysis to assess the correlation between brand image consistency and media coverage with sell-thru rates and launch activities. After conducting this study, it is revealed that when a luxury brand and a mass-market company collaborate on a fashion line, there is a high correlation between the luxury brand's image and media activity in the form of articles published and social media implemented and a high sell-thru rate. The findings showed consistency between collaborations with strong brand recognition and high amounts of media activity with elevated traffic and sell thru rates. This thesis provides a foundation of research and paves the way for future studies to determine the effects of luxury brand and mass-market retailer collaborations in order to exploit this powerful marketing and sales strategy.

INDEX

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