

# College of Agriculture and Life Sciences

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2016 – 2017

**RESEARCH HONORS  
PROGRAM ABSTRACTS**

**Cornell CALS**  
College of Agriculture and Life Sciences

The College of Agriculture and Life Sciences (CAL S) is a pioneering practitioner of purpose-driven science and Cornell University's second largest college. We work across disciplines to tackle the challenges of our time through world-renowned research, education and outreach. Since our founding, we have been evolving to meet the changing needs of our world. As our areas of study have diversified, we have established top-ranked programs and over 20 majors in community and rural development, environment and natural resources, food and nutrition, applied economics, agriculture, international programs and life sciences. CAL S is fundamentally invested in improving the lives of people, their environments and their communities both in New York state and around the world.

An engaged and inspired student body is critical to CAL S' success. The 2016-2017 honors thesis projects described in this booklet demonstrate an impressive capacity for personal dedication, mature scholarship and intellectual growth. The original research contained herein examines some of the most pressing and relevant questions of our time.

Many students consider the research projects they undertake as undergraduates in CAL S to be among the most challenging, enduring, and rewarding of their Cornell experiences. As a faculty member, I have witnessed first-hand among my own advisees the formative impact that undergraduate research can have on budding young scientists. As dean, I am dedicated to fostering the college's unwavering commitment to providing our undergraduates with these life-changing research opportunities.

I am extremely proud of our undergraduate students and their achievements, and I wish them the very best in their future endeavors. I also appreciate the dedicated faculty who supervised these honors research projects and mentored these students to achieve their fullest potential. On behalf of the CAL S community, we welcome them as the next generation of scientific leaders and innovators.

Kathryn J. Boor, Ph.D.  
*The Ronald P. Lynch Dean of  
Agriculture and Life Sciences*

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## Passive and Active Sensors for Yield Predictions and Precision Nitrogen Management in New York

LINDSAY A. CHAMBERLAIN

Under the supervision of Dr. Quirine M. Ketterings  
Department of Animal Science

Normalized Difference Vegetation Index (NDVI), a ratio of reflected red and near infrared light, quantifies greenness and biomass of a crop canopy. Previous work has shown that accurate predictions of end-of-season yield can be made for corn (*Zea mays* L.) grain, corn silage, and forage sorghum (*Sorghum bicolor* L.) using midseason NDVI measurements from active sensors in New York (NY). Active sensors, such as the GreenSeeker crop sensor, emit their own light and measure reflectance in close proximity to the crop canopy (< 1 m). The NDVI can also be measured with passive sensors, including cameras mounted on unmanned aerial systems (UAS). Passive sensors (cameras) rely on sunlight for illumination and reflectance measurements are therefore affected by atmospheric conditions. In this study, NDVI was measured at 6 time points throughout the day using both active (GreenSeeker) and passive (UAS mounted cameras) sensors on one day each for corn and sorghum N rate studies. Drought in NY in 2016 impacted the physical features of both crops (rolling of leaves mid-day) and reduced the reliability of end-of-season yield predictions using midseason NDVI measurements. As a result of the drought, time of sensing during the day impacted NDVI measured with both active and passive sensors, but NDVI varied more for the passive sensor. Additional studies are needed to evaluate the impact of variations in sunlight intensity or sun angle in a non-drought year.

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## Genotypic verification of CRISPR-Cas9-mediated gene editing in canine embryos produced by *in vitro* fertilization

HELENA HAUCK DE OLIVEIRA

Under the supervision of Dr. Alexander J. Travis  
The James A. Baker Institute for Animal Health, College of Veterinary Medicine

CRISPR-Cas9 is one of the most exciting and rapidly developing technologies in the field of gene-editing. Combined with the recently successful techniques of *in vitro* fertilization (IVF), embryo cryopreservation, and embryo transplantation (ET) in the dog, *Canis familiaris*, CRISPR-Cas9 has the potential to lead to important advancements for canid species, ranging from eliminating genetic diseases in the domestic dog to conserving genetic diversity in wild canids. Although CRISPR-Cas9-mediated gene editing has successfully been performed in the domestic dog with auto-transplantation of embryos (Zou et al., 2015), that work targeted destruction of a functioning gene. Gene repair paired with IVF and allo-transplantation has yet to be performed. In preliminary studies, we attempted gene editing using CRISPR-Cas9 on embryos produced by IVF using a recently established protocol for the dog (Nagashima et al., 2015). After injection of the CRISPR-Cas9 construct, embryo cryopreservation and ET, we found that efficiency of live births was low. Through

DNA purification, PCR, cloning, and sequencing, we genotyped canine embryos injected with CRISPR-Cas9 constructs. All injected embryos genotyped lacked evidence of successful gene-editing. Difficulties created by genome amplification in the presence of the injected template sequence revealed the need for improved methods of genotyping embryos having very few cells, with a need for discrimination of single base changes. Therefore, improvements in verification methods will need to be made before the efficacy of CRISPR-Cas9 gene repair can be easily evaluated.

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## Proximal Canopy Sensing to Predict the Quality of Forage Sorghum and Optimal Time of Harvest

CHUTAO LIU

Under the supervision of Quirine M. Ketterings  
Department of Animal Science

Proximal canopy sensing with the Normalized Difference Vegetation Index (NDVI) is a promising tool for predicting end-of-season yield of forage sorghum (*Sorghum bicolor* (L.) Moench). This study investigated the relationship between NDVI data and forage yield as well as quality of brachytic dwarf brown midrib (BMR) forage sorghum over different harvest timings. Trials were established in Aurora, NY, in 2015 and 2016, and in Varna, NY, in 2015. Multiple sensor scans were performed during the growing season, and sorghum was harvested weekly from 63 until 124 days after planting (DAP). For each harvest, forage yield as well as crude protein, acid detergent fiber, neutral detergent fiber, in-vitro fiber digestibility at 30-hour fermentation, total digestible nutrients, lignin, and starch were analyzed. Forage yield, quality, and NDVI data from three trials were combined using average plant height at sensing to integrate data across sites. For each plant height at sensing, multiple linear regression was performed (yield or quality =  $NDVI / DAP_{at\ sensing} + \text{total days of growth}$ ). Results showed that regression models based on the two years of trials in Aurora performed well ( $0.69 < R^2 < 0.91$ ) at three plant heights at sensing (0.53, 0.74, and 0.95 m). Model validation showed that yield and quality prediction models had better applicability across different spatial patterns than across different temporal patterns. Mid-season proximal canopy sensing showed potential in predicting BMR sorghum yield and quality, which can be further developed to assist farmers in determining the optimal time of harvest.

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## Effects of microalgal phytochemical astaxanthin on heat stress resistance, meat quality, and enrichment of omega-3 fatty acids in tissues of broiler chicks

GUANCHEN LIU

Under the supervision of Xingen Lei  
Department of Animal Science

This research was to determine effects of incorporating astaxanthin (AST)-rich microalgae (*Haematococcus pluvialis*) in diets for broiler chicks on their growth performance, meat quality,

response to heat stress, and enrichment of omega-3 fatty acids in tissues. One hundred forty-four broiler chicks were allotted into three treatment groups. The three experimental diets contained 0, 0.08, and 0.32% microalgae product, respectively. Heat stress was induced from Weeks 4 to 6. Samples were collected at the end of Weeks 3 and 6. Feed intake and body weight gain of chicks were recorded weekly. The oxygen radical absorbance capacity (ORAC), malondialdehyde (MDA) concentration, glutathione concentration and omega-3 fatty acid concentration in the liver, breast, and thigh samples were measured. Meat quality was tested on the breast and thigh samples. The concentrations of AST in the diets were analyzed using high performance liquid chromatography. There was no significant difference in growth performance among the three groups except for a lower ( $P < 0.05$ ) feed/gain ratio in the treatment groups than the control at Week 6. Supplemental microalgal AST resulted in dose-dependent ( $P < 0.05$ ) increases of ORAC values and decreases of glutathione concentrations and water holding capacity of the breast and thigh. The effects of microalgal AST on concentrations of MDA and omega-3 fatty acids in the three tissues or texture profile of the muscle samples were not statistically significant. In conclusion, supplemental microalgal AST elevated ORAC values in the tissues of broiler chicks, which might contribute to their resistance to heat stress.

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## Ultrasonographic Study of Post-Milking Changes in the Teat Canal Diameter of Dairy Cattle

JACLYN M. MELVIN

Under the supervision of Dr. Daryl V. Nydam and Dr. Matthias J. Wieland  
Department of Population Medicine and Diagnostic Sciences

Changes in teat canal diameter after machine milking have been related to teat penetrability and susceptibility to new infections. However, these post-milking changes have not yet been assessed by modern ultrasonography. Such analysis could improve understanding of teat canal changes and offer insight into how cows should be managed after milking in order to prevent new intramammary infections. In this study, ultrasonographic images were taken of the left front and right hind teats of eighty Holstein cows. Imaging occurred prior to attachment of the milking cluster, immediately after removal of the milking cluster, and then at every hour after milking until eight hours had elapsed. Teat canal diameter (at the proximal, middle, and distal regions), teat canal length, and teat canal cross-sectional area were measured. Teat canal length and area increased during milking and remained elevated throughout the milking interval. All three measurements of teat canal diameter decreased during milking but subsequently increased during the milking interval. The widest teat canal diameters were recorded between six and eight hours after milking. All measurements failed to return to their pre-milking values. These findings suggest that the teat is unable to fully recover from milking during an eight-hour milking interval, leaving the teat in a near-constant state of remodeling. The dilation of the teat canal diameter during the milking interval likely leaves cows at greater risk for acquiring new intramammary infections across this entire time period, especially between six and eight hours post-milking when the teat canal diameter is greatest.

## Genomic Analysis of Congenital Laryngeal Collapse (CLP) in the Alaskan Sled Dog

TYLER R. OLSON

Under the supervision of Dr. Heather Huson  
Department of Animal Science

Congenital laryngeal paralysis (CLP) is a disease that is characterized by the inability to abduct one or both arytenoid cartilages in the larynx. Clinical signs of CLP generally present in dogs between 6 weeks and 9 months of age. CLP has been documented in multiple breeds, including the Alaskan sled dog for approximately 50 years. Alaskan sled dogs are a recognized population of working dogs used for long distance racing, sprint racing, and hobbyist events. This study sought to find genomic regions associated with CLP in the Alaskan sled dog. To this end, 19 dogs diagnosed with CLP and 34 unaffected control dogs were genotyped at 173,662 single nucleotide polymorphisms (SNP). After implementing quality control measures for both SNPs and samples, 131,270 SNPs were analyzed in multiple genome-wide association studies (GWAS) to test for association with CLP. Eight SNPs located on chromosomes 1 (n=2), 4 (n=1), 16 (n=2), 18 (n=1), and 32 (n=2) passed the false discovery rate significance level of less than 0.05. Of these, six SNPs were found to be located within genes *MTUS1* (n=2), *NAA35* (n=1), *FADD* (n=1), *ANO1* (n=1), and *AFF1* (n=1). *MTUS1* codes for a protein that interacts with angiotensin II receptors. *FADD* mediates apoptotic signals. *ANO1* is involved in smooth muscle contraction. *NAA35* is involved in the apoptosis and contraction of smooth muscle. *AFF1* is a regulator of RNA polymerase II. Currently these genes are undergoing further analysis using whole-genome sequencing in order to determine the correct gene and potentially the causative mutation.

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## Amino Acid Composition of Various Feeds after Multiple Hydrolysis Times for Use in Ruminant Diets

ANDRES F. ORTEGA

Under the supervision of Mike Van Amburgh  
Department of Animal Science

Nutrition models have improved their information concerning the prediction of supply and requirements of amino acids (AA), which is important when formulating diets. However, data has demonstrated that the AA content was not correctly described after the standard 21 to 24hr acid hydrolysis period, used to break down protein into constituent AA, and that longer hydrolysis times might be needed for certain AA. Thus, the objective of this study was to compare the AA content of various ruminant feeds at multiple hydrolysis times to the standard hydrolysis time. Twenty-six feeds that were used previously in the formulation of diets for studies that evaluated omasal flow of digesta and AA and other nutrient flows were chosen. Feeds were analyzed for all essential AA by HPLC following hydrolysis at 110°C in a block heater for 2, 4, 6, 12, 18, 21, 24, 30, 48, 72, 120 and 168h using acid hydrolysis for all most essential AA (EAA). Barium hydroxide was used for Trp and performic acid pre-oxidation for the sulfur AA. Following hydrolysis, least-squares non-linear regression was used to determine the AA content in feeds among the hydrolysis times. The EAA continued to be released after the 24-hour time point and

the hydrolysis averaged 0.4 mg/h. The branched chain AA (BCAA) and Lys were found to have the greatest hydrolysis rates ranging from 0.2 to 0.7 mg/h. This leads to the conclusion that, for certain essential AA, there is currently an underestimation of the content of those AA in ruminant feeds.

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## Production Responses to Supplementation With Rumen-Protected Lysine and Two Sources of Rumen-Protected Methionine in Holstein Cows

CLAIRA R. SEELY

Under the supervision of Dr. Tom Overton  
Department of Animal Science

Multiparous Holstein cows (n=57) averaging 124 days in milk were used to determine production responses to supplementation with rumen protected lysine and two sources of rumen protected methionine. Following a 2-wk covariate period, cows were randomly assigned to one of three diets. Diets consisted of CON, a control diet containing no rumen protected Met or Lys, and two experimental diets (AA-M and AA-S), which were supplemented with rumen protected Lys and Met. Methionine was supplemented to the AA-S diet using Smartamine<sup>®</sup>-M and to AA-M diet through MetiPEARL<sup>™</sup>. Both AA-S and AA-M were provided rumen protected Lys using USA Lysine<sup>®</sup>. The CON diet contained 0.98g Met/Mcal of metabolizable energy, both AA-M and AA-S contained 1.14g Met/Mcal of ME. Lysine was supplied to CON at 2.85g Lys/Mcal of ME and to both AA-M and AA-S at 3.07g Ly/Mcal of ME. Dry matter intake and milk yield were not different among diets (P=0.54 and 0.84 respectively). Milk true protein percentage (2.92%, 2.99%, and 2.98%) was increased (P = 0.01) for cows fed AA-S and AA-M compared to controls, but was not different between AA-S and AA-M (P = 0.81). Milk protein yield was not different among diets (P = 0.58). Percentages and yields of milk fat (P=0.54 and 0.82 respectively) and energy-corrected milk yield (P = 0.75) were not different among diets. Feed efficiency was increased for the AA-M cows (P=0.056). Body weights and BW change were different across all groups (P=0.01 and <0.01 respectively), with the AA-M cows being consistently heavier.

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## Naturally Acquired Canine Herpesvirus-Associated Meningoencephalitis

MORGAN T. SHELTON

Under the supervision of Andrew D. Miller  
Department of Biomedical Sciences

Canid alphaherpesvirus-1 (CHV) is a common viral infection that causes significant and fatal disease in vulnerable puppies. While neuropathology of experimentally infected CHV has been described, it is poorly characterized in naturally acquired CHV. The aim of this study was to complement older studies as well as describe the histologic, immunohistochemical, and *in situ* hybridization features of CHV encephalitis in the dog. Six female and eleven male puppies of various breeds, ranging in age from stillborn to 57 days old were included. Initial histological analysis showed multifocal glial nodules (16/17, 94%), meningeal infiltrates (15/17, 88%), and cerebellar cortical necrosis (6/9, 67%). However,

strong inflammation was not a substantial feature. Immunohistochemistry showed that while T cells (CD3-positive) outweighed B cells (CD20-positive), the overall number of lymphocytes was small in all cases in both the glial nodules and meninges. In all cases, glial nodules were diffusely immunoreactive for Iba1 (histiocyte marker). Limited to no immunoreactivity for MAC387 (macrophages) was present while prevalent immunoreactivity for GFAP (glial fibrillary acidic protein) showed that astrocytosis and astrogliosis were not a significant feature. *In situ* hybridization directed at the CHV thymidine kinase gene showed CHV nucleic acid in the meninges and parenchyma (12/17, 71%) and in random, individual neurons (6/17, 35%). These results clarify the pathology of naturally acquired CHV infection and show that developing cerebellar granular neurons are an important site of viral replication.

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## Longitudinal Study of Metritis in Dairy Cattle

EMILY M. SITKO

Under the supervision of Dr. Soon Hon Cheong  
College of Veterinary Medicine, Department of Theriogenology

Metritis is a common and costly disease of dairy cattle. Affected cows have decreased milk production and reproductive performance and are more likely to be culled. The incidence of metritis is higher in primiparous heifers and lower in multiparous cows, and vaccination of cows against the common bacteria associated with metritis is effective in reducing incidence. Taken together, these observations suggests that cows may be developing immunity from previous exposure to the bacterial agents, thus our hypothesis is that cows affected by metritis in previous lactations will have a lower risk of developing metritis. The objective was to determine if cows that had metritis in the previous lactation were less likely to develop metritis again in the subsequent lactation. A retrospective longitudinal epidemiologic study was performed on 15,692 Holstein dairy cows. Overall metritis incidence was 15.61 %. Incidence of metritis was higher for primiparous heifers at 20.63 % compared with 11.67 % in multiparous cows. To test our hypothesis of metritis in previous lactation affecting disease risk in future lactation, only cows that survived to the second lactation were used (10,427 cows). Contrary to our hypothesis, cows that had metritis in the first parity and survived to the second parity were more likely to develop metritis again in her second lactation (odds ratio 1.61;  $p < .0001$ ). This suggests that there may be an intrinsic increased susceptibility of these cows to developing metritis.

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## Mitochondrial Translocator Protein (TSPO) Enhances Lipolysis in Adipose Tissue

CARMEN R. SMITH

Under the supervision of Vimal Selvaraj  
Department of Animal Science

Molecular function of the mitochondrial translocator protein (TSPO) is unknown. Previously, we reported that tissues active in lipid metabolism, including white adipose tissue (WAT), express high levels of TSPO. In order to investigate TSPO function in WAT, we examined changes to lipid

metabolism with the loss of TSPO, and compared effects mediated by TSPO-binding pharmacological agents. TSPO floxed (Tspofl/fl) and global TSPO knockout (Tspo<sup>-/-</sup>) mice showed no baseline differences in WAT weight or adipocyte size. When challenged with a high fat diet (HF; 45% kcal from fat), Tspo<sup>-/-</sup> mice gained more gonadal and subcutaneous fat than Tspofl/fl mice, although body weight gain was not significantly different between these groups. Histological examination showed marked increase in adipocyte hypertrophy in Tspo<sup>-/-</sup> compared to Tspofl/fl mice after HF. Evaluation of gene expression changes suggested decreased lipolysis indicated by significant downregulation of hormone-sensitive lipase and adipose triglyceride lipase in WAT of Tspo<sup>-/-</sup> mice fed HF diet compared to Tspofl/fl. These in vivo data suggest that loss of TSPO enhanced lipid accumulation in WAT. In agreement, differentiation of primary preadipocytes in vitro showed significantly greater lipid droplet accumulation in Tspo<sup>-/-</sup> compared to Tspofl/fl cells. TSPO expression levels were significantly upregulated during this 4-day differentiation of Tspofl/fl adipocytes. Treatment of primary preadipocytes with TSPO-binding drugs PK11195 or etifoxine during differentiation also increased lipid droplet accumulation in Tspofl/fl cells but not in Tspo<sup>-/-</sup> cells, indicating that the effect was specifically mediated by TSPO. These results uncover a novel role for TSPO in regulating lipid homeostasis in adipocytes.

## Quantitative Fluorometric Assay for the Detection of *Escherichia coli* in Ground Beef Using Engineered Phages

ANQI CHEN

Under the supervision of Dr. Sam R. Nugen  
Department of Food Science

Early detection of pathogenic bacteria is significant for the prevention of foodborne pathogen outbreaks. In this study, we focused on the detection of *Escherichia coli* (*E. coli*) based on a quantitative fluorometric assay using genetically engineered bacteriophage (phage). The presence of *E. coli* was indicated by  $\beta$ -galactosidase ( $\beta$ -gal), which converted the substrate 4-methylumbelliferyl  $\beta$ -D-galactopyranoside (MUG) into a fluorophore 4-methylumbelliferone (MU). The quantification of fluorophore reflected the existence of  $\beta$ -gal as well as the *E. coli* bacterial cells. T7<sub>lacZ</sub> bacteriophages were used to recognize and lyse the bacterial cells in order to release the  $\beta$ -gal enzyme; more importantly, they could also overexpress the enzyme to increase the sensitivity of this assay. The proposed method can reach a detection limit of 10CFU/mL in ground beef samples after an incubation of 7h. When compared to current methods, this approach is easier to handle and has high sensitivity, making it an ideal candidate for rapid detection and food safety assurance.

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## STING-Induced Interferon Response to Human Herpesvirus 6A Infection in Human Monocytes

MARK DERBYSHIRE

Under the supervision of Dr. Cynthia Leifer  
Department of Microbiology and Immunology, Cornell University College of Veterinary Medicine

The primary role of the immune system of any organism is to defend a host against harmful infectious agents. The virus Human Herpesvirus (HHV) 6A has been implicated as a potential etiological agent for the progression of certain autoimmune conditions including multiple sclerosis, and yet very little is known about how the innate immune system responds to this pathogen. Recent studies have suggested that the innate immune Toll-like receptor family may play a role in response to HHV-6A; however, HHV-6A enters and replicates within the cytosol of host cells. Here we have provided preliminary evidence that the cytoplasmic DNA sensor STING is used to initiate host response to HHV-6A exposure using a unique reporter human THP1-Dual monocyte cell line.

## DNA replication timing variation in cancer

KRISTJANA FRANGAJ

Under the supervision of Amnon Koren  
Department of Molecular Biology and Genetics

Cancer is a genetic disease that is promoted by mutations in key genes that control all growth. DNA replication timing is known to influence the rate and pattern, as well as in which strand mutations occur, however our knowledge of DNA replication timing in cancer is limited. In this project, I sought to better understand the variation of DNA replication timing in different human cancers. I applied high throughput DNA sequencing, integrating experimental and computational biology, to generate genome-wide replication timing profiles for 11 cancer cell lines. I found that the S phase length and DNA content varied among different cancer cell lines and that some cell lines were highly aneuploid. Importantly, I observed that replication timing is stable across cancers from the same tissue but differed across cancers from different tissues. I identified an outlier cell line, RKO, which displayed a very different replication timing pattern compared to all other cell lines. RKO exhibited large regions of difference across the genome that were not observed in any of the other cell lines. Our results provide the basis for a comprehensive characterization of replication timing variation in cancer and for advancing our understanding of cancer genomics.

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## Population Scale Transcriptome Profiling from Mixed Samples using Single-Cell Analysis

DESTINI J. G. GIBBS

Under the supervision of Dr. Hojoong Kwak  
Department of Molecular Biology and Genetics

One powerful tool in understanding how genetic variations can lead to changes in gene expression across human population involves the measuring of mRNA expression levels in large scale, with high-throughput sequencing. Still, large scale analysis is often limited by the amount of sample handling and batch effects. To circumvent these problems in transcriptome profiling, I tested the strategy of pooling multiple samples while using single cell RNA sequencing technology. I used the Drop-seq technique to sequence the RNA from 10 lymphoblastoid cell lines in individuals involved in the International HapMap project. Multiplexing RNA-sequencing led to the creation of a standardized pipeline that maps SNPs from Drop-seq reads, in order to accurately identify each of the 10 individuals, as well as to quantify genes containing high level of expression. Approximately 82.9% of Drop-seq reads were aligned and re-assigned across the ten individuals in this experiment, and 74.9% of the single cells were matched via SNPs. The results illustrate that single-cell analysis of multiple individuals can be conducted in a sole experiment, thereby effectively reducing multi-sample handling and batch effects that would occur in sequencing individuals one at a time.

## On identifying evolutionary lineages and delimiting species: A case study in *Glycine* subgenus *Glycine* (Leguminosae)

SHUJIE LI

Under the supervision of Dr. Jeffrey Doyle  
Plant Breeding and Genetics Section, School of Integrative Plant Science

The concept of species is one of the most fundamental in biology. Definition of the term is highly variable, depending on the field of study and the goals of the research in question. Species definitions emphasizing different characteristics of lineage differentiation lead to differences in species delimitation. Allopolyploid complexes in plants are particularly challenging for species delimitation due to the complex morphological character patterns created by hybridization, coupled with reproductive isolation by ploidy. Such a species complex is *Glycine tomentella*, one of the wild perennial relatives of the cultivated soybean (*G. max*), in the *Glycine* subgenus *Glycine*. The T4 triad (*G. tomentella* T4 and its potential diploid progenitors) is studied here: *G. tomentella sensu stricto*—the allopolyploid T4—and its diploid progenitors *G. tomentella* subgroups D3, D5B as well as two species previously separated from *G. tomentella sensu lato*, *G. arenaria* and *G. pindanica*. Various analyzing methods were used to provide separate and general results, which included principal component analysis (PCA), decision tree, Tukey's honest significant difference test (Tukey's HSD test, Tukey's test) and random forest. Most results showed that within ploidy, the species/subgroups are morphologically different, with tetraploid T4 highly resembling diploid D5Ba. A dichotomous key of the plants studied was generated, and the most differentiating characters were identified from an extensive pool of morphological characters. Combining preliminary results from genotyping-by-sequencing (GBS, Sherman-Broyles et al., unpublished data), all the diploid subgroups in this study were proposed to merit recognition as species, but the tetraploids lineages have remained unclassified due to uncertainty concerning genomic donors.

## The intersection between whole genome duplication and endoreduplication in *Arabidopsis* sepal size control

XINRAN MA

Under the supervision of Dr. Adrienne H. K. Roeder  
Plant Biology Section, School of Integrative Plant Science

Polyploidy refers to a phenomenon in which organisms have more than two sets of homologous chromosomes in their genomes. Two mechanisms of polyploidy in plants are whole genome duplication (WGD) and endoreduplication. They can lead to transformations in morphology and physiology at both cell and organism levels. The main difference between the two mechanisms is that WGD raises the base genome level in the entire plant while endoreduplication only influences selected individual cells. The *Arabidopsis* sepal epidermis contains cells with a variety of sizes. Cell size in this model system is positively correlated with both endoreduplication and WGD. However, organ size is mostly affected by WGD. In preliminary study, we studied the LGO protein, a SIM-related CDK inhibitor that promotes endoreduplication and sepal giant cell formation. In LGO OX lines which increase endoreduplication level, we discovered that a decrease in fold change in sepal size from diploids to tetraploids. Conversely,

*lgo* mutant line that decreases endoreduplication presented the opposite effect. Both results suggest that endoreduplication limits the increase in organ size that occurs due to WGD. Later, PDF2 which is expressed throughout the epidermis has been tested. Even though endoreduplication level was reduced in *pdf2* mutant lines, the fold change of organ size is significantly reduced in *pdf2* sepals compared with wild-type sepals. The interaction between endoreduplication and WGD studied in *pdf2* is the opposite of what has been discovered in LGO plants. To explain the different results shown in *pdf2* and *lgo*, further investigation of total cell number is needed to generate a clearer picture of the events occurring at the cellular level.

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## Approximate Bayesian Computation for Studying Selective Sweep Signatures in Local Coalescence Trees

ANDREW R. MARDERSTEIN

Under the supervision of Dr. Philipp Messer  
Department of Biological Statistics and Computational Biology

Understanding the process of rapid molecular adaptation is important for many key challenges humanity faces today, such as the evolution of pesticide and drug resistance. Our standard population genetic model for describing rapid molecular adaptation is the selective sweep, in which a previously rare or absent allele is quickly driven to fixation by positive selection. Selective sweeps can be distinguished into hard sweeps, where a single adaptive mutation arises in the population and then goes to fixation, and soft sweeps, where several adaptive mutations at the same locus rise in the population simultaneously. These soft sweeps can occur either because the adaptive alleles were already present as standing genetic variation (SGV) at the onset of positive selection, or because they arose independently from recurrent *de novo* mutation (RDN). In this thesis, I develop an Approximate Bayesian Computation (ABC) approach to study whether we can distinguish these different sweep types and infer their evolutionary parameters from the shape of the local coalescence tree at the sweep locus. I demonstrate that my method can reliably infer the selection coefficient and softness of a sweep under various parameter settings. I further show how my method can be used with Bayes factors for differentiating between soft sweeps from SGV and those from RDN, as well as from neutral selection. These findings demonstrate that the local coalescence tree at a sweep locus contains valuable information on the parameters of the sweep and motivates further studies that aim to infer such trees from real population genomic data through reconstruction of ancestral recombination graphs.

## Sex- and age-based latitudinal segregation in the wintering distribution of herring gulls (*Larus argentatus*)

ODILE V. J. MAURELLI

Under the supervision of Dr. David N. Bonter  
Cornell Lab of Ornithology

In species with obligate biparental care such as the herring gull, skewed adult sex ratios are maladaptive, excluding some sexually mature individuals of the overrepresented sex from breeding. Working in a herring gull colony with a known female skew in the adult population, I investigated potential factors leading to this skewed sex ratio. Previous research in my study system investigated sex ratios at the egg and fledging stages, but found no deviation from parity. This suggests differential survival in the post-fledging, but pre-breeding period may contribute to biased sex ratios in the adult population. To test for spatial segregation during the nonbreeding season, 1,392 individual gulls were banded and bled as chicks and off-island resight data were contributed by the public. Using 344 encounters of banded birds, I found that older individuals winter closer to the nesting colony than younger individuals, and first-year females travel farther from the nesting colony than any other age- and sex-groups. Because females appear to survive better than males into adulthood, these results suggest that spending the winter farther south is advantageous. Although distance from the nearest shore is highly variable in females of different ages, males are consistently detected farther inland than females across all age categories. To my knowledge, this is the first study to find a difference in distance from shore as a function of sex in herring gulls.

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## Identifying new components of the bone morphogenetic protein (BMP) signaling pathway using a genetic suppressor screen in *C. elegans*

ALEXANDRA MCKILLOP

Under the supervision of Dr. Jun “Kelly” Liu  
Department of Molecular Biology and Genetics

The bone morphogenetic protein (BMP) signaling pathway plays important roles in developmental and homeostatic processes in multicellular organisms. In humans, a malfunction in this pathway can cause diseases such as cancers and cardiovascular disorders. Because of its importance, BMP signaling needs to be tightly regulated spatiotemporally in vivo. Our lab has designed a genetic screen that allowed the identification of novel, evolutionarily conserved, modulators of BMP signaling in *C. elegans*. I performed this screen in order to identify new modulators of the BMP pathway. After screening through 7,040 haploid genomes, I isolated 41 mutations. Twenty-six of these mutations are true-breeding and exhibit a penetrance of over 50%. I then carried out a series of genetic crosses and characterized 21 of these mutations to determine if they are dominant, recessive or partially dominant, whether they are single-locus or multi-loci mutations, and whether they are located on chromosome III. I then used the SNP-WGS (single nucleotide polymorphism-whole genome sequencing) mapping method in an attempt to identify the corresponding genes for these mutations. Sequencing data showed that some of these mutations affect genes known to function in the BMP pathway, while others identify potentially new

factors in BMP signaling. I focused on one of them, *smoc-1*, which encodes a predicted secreted modular calcium binding protein SMOC-1. I have outcrossed the *smoc-1* mutant alleles and have generated *smoc-1* mutant strains carrying different GFP markers in order for future analysis of the function of *smoc-1* in BMP signaling.

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## Development and characterization of calcium-sensitive bioluminescent indicators for reporting neural activity

HELEY MA ONG

Under the supervision of Dr. Nozomi Nishimura  
Department of Biomedical Engineering

In a cell,  $\text{Ca}^{2+}$ -signaling plays an important role in many cellular functions. One important function of  $\text{Ca}^{2+}$ -signaling is in neuronal signal transmission. When neurons fire, they communicate with  $\text{Ca}^{2+}$ -signaling at rapid speeds on the millisecond time scale. These fast communications can be detected with  $\text{Ca}^{2+}$ -dependent bioluminescent photoproteins, like aequorin from *Aequorea victoria* that can be manipulated to emit different wavelengths of light. The emission of light triggered by  $\text{Ca}^{2+}$  allows us to track neural activity because when a neuron fires, intracellular  $\text{Ca}^{2+}$  increases. To keep up with the rapid pace of neuronal action potentials,  $\text{Ca}^{2+}$  sensitive indicators need have a fast rise to enable the quick detection of an action potential and fast decay as not to interfere with the detection of the next firing event within the same neuron. In this study, faster reporters of neural activity were made by fusing fluorescent proteins to a faster  $\text{Ca}^{2+}$ -dependent photoprotein called obelin, and more efficient red indicators were generated by creating dimers out of a new red fluorescent protein, mScarlet.

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## Passive Acoustic Monitoring of Vocally Active Fish as Estuarine Indicators for Everglades National Park Restoration

MADLINE L. PIELMEIER

Under the supervision of Dr. Aaron Rice  
Bioacoustics Research Program, Cornell Lab of Ornithology

As human populations and coastal development increases, anthropogenic pressures on estuaries surge with stress coming from man-made alterations to the hydrologic regime. Florida Bay, an estuary within Everglades National Park, has experienced many of these pressures and has therefore become a focus for restoration efforts. This study aims to evaluate the acoustic presence of two well-studied fish species, the spotted seatrout (*Cynoscion nebulosus*, family Sciaenidae) and gulf toadfish (*Opsanus beta*, family Batrachoididae) in three basins within the Florida Bay portion of Everglades National Park for the purpose of detecting the anthropogenic stressors. I conducted a passive acoustic survey at three different sites over several days between 2014 and 2016 to document call rates of spotted seatrout and gulf toadfish. I examined the influence of salinity and bottom temperature on the spatial and temporal patterns of their acoustic behavior to examine the suitability of these two species as potential ecological indicators of estuarine change in Florida Bay. The number of gulf toadfish calls per day at each site was

significantly associated with salinity, water temperature, lunar phase, and location; however, spotted seatrout calling patterns showed no significant relationship with these environmental variables. The varying call rates produced by gulf toadfish as a factor of location, salinity, and water temperature demonstrates the value of fish sounds as potential estuarine indicators and passive acoustic techniques as a tool for monitoring estuary changes.

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## Fluorescent Live Imaging of Mitochondrial Extrusion in *Tetrahymena thermophila*

GARY TAN

Under the supervision of Dr. Donna Cassidy-Hanley and Dr. Theodore Clark  
Department of Microbiology and Immunology, College of Veterinary Medicine

In addition to providing energy for cellular processes, mitochondria are also highly motile organelles that are adapted for responding to cellular stress. *Tetrahymena thermophila* has been shown to expel intact mitochondria into the extracellular space following surface antigen crosslinking or heat shock, utilizing a calcium dependent mechanism. Although there is conclusive evidence of mitochondrial extrusion in response to antibody crosslinking, the process has not yet been visualized in living cells. Observation of the extrusion process in real time will provide important information regarding the mechanism and timing of mitochondria jettisoning. To facilitate visualization of the mitochondria extrusion process, a double transformed *Tetrahymena* strain expressing both a mitochondria localized green fluorescent protein and a highly abundant *Ichthyophthirius multifiliis* surface antigen has been engineered and, microscopic techniques for imaging mitochondria extrusion in live cells in real time have been developed. Initial results show that mitochondria migrate to the cell periphery, where they are quickly jettisoned from the membrane, leaving mitochondria free gaps randomly distributed along the cell periphery. Using the reagents and methods developed, further examination of the mitochondria extrusion process in living cells will provide useful information regarding mitochondrial response to stress.

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## IRE1 $\alpha$ Links SEL1L-HRD1 ERAD to Cell Survival

NIR TOMER

Under the supervision of Dr. Ling Qi and Dr. Patrick Stover  
Division of Nutritional Sciences

SEL1L and IRE1 $\alpha$  are two proteins necessary for maintaining homeostasis in the endoplasmic reticulum. Both SEL1L and IRE1 $\alpha$  participate in two key pathways for clearing misfolded proteins. SEL1L is critical for HRD1 mediated endoplasmic reticulum-associated degradation (ERAD), and IRE1 $\alpha$  is critical for coordinating and facilitating the unfolded protein response (UPR). Previous studies have linked IRE1 $\alpha$  to apoptosis, but no research has shown a direct link between SEL1L and IRE1 $\alpha$  induced apoptosis. Therefore, the aim of my project was to dissect the interaction between SEL1L and IRE1 $\alpha$  in triggering apoptosis as a response to cellular accumulation of misfolded proteins. Using in vivo and in vitro models, I showed that in situations of SEL1L/ERAD deficiency, IRE1 $\alpha$  expression

increases and triggers cell death by apoptosis. When IRE1 $\alpha$  is knocked out together with SEL1L (DIKO) in mouse embryonic fibroblasts (MEF), cells grow quicker and more robustly compared to cells with SEL1L single knockout (SIKO). Additionally, DIKO mice exhibit significantly less dramatic weight loss and premature death compared to SIKO mice. Investigating the mechanism for the protective effect of knocking out IRE1 $\alpha$  and SEL1L on cell viability, we discovered that in both mouse and MEF cell models, the growth increase in the DIKO model was driven by reduced activity of the apoptotic pathways (caspase 3 and PARP mediated apoptosis). DIKO mice and MEF cells exhibit significantly less apoptosis compared to their SIKO counterpart. Therefore, we conclude that IRE1 $\alpha$  is critical to cell survival and to maintaining physiologic homeostasis by linking mammalian ERAD machinery to apoptosis.

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### Overexpression of *CYP9M6*, *CYP9M5*, and *CYP6BB2* is Linked to Permethrin Resistance in *Aedes aegypti*

RAKSHIT TYAGI

Under the supervision of Dr. Jeffrey G. Scott  
Department of Entomology

*Aedes aegypti* is an important vector of four human diseases: dengue fever, yellow fever, chikungunya, and Zika, all of which debilitate millions of humans each year. Due to intense use of insecticides, *A. aegypti* has developed resistance to insecticides such as permethrin. Cytochrome P450 monooxygenases (CYPs) are enzymes which detoxify xenobiotics such as insecticides. A previous study identified several overexpressed CYPs in resistant *A. aegypti* strains, but used genetically unrelated strains so no conclusions regarding CYP overexpression and resistance linkage could be drawn. This experiment uses the *A. aegypti* strain IsoALL, along with its related parental strains Singapore (SP) and Rockefeller (ROCK), to determine which CYPs had their overexpression linked to resistance. This is done using real-time quantitative PCR. The results show that *CYP9M6*, *CYP9M5*, and *CYP6BB2* are linked to permethrin resistance. These findings will help direct future studies to find strategies to mitigate insecticide resistance.

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### Creation of an iPSC calcium indicating sensor under the control of an $\alpha$ MHC promoter, which can be expressed in cardiomyocytes

BAYAN YAZDI

Under the supervision of Michael Kotlikoff  
Department of Biomedical Sciences, College of Veterinary Medicine

Heart disease remains the leading cause of death in the United States. During an infarction myocardial cell death occurs, which in conjunction with the inability of the cardiomyocytes to regenerate and replace dead cells decreases the heart's functionality. Human induced pluripotent stem cells (iPSCs) have shown much promise for future therapeutic interventions and research has focused on differentiating iPSCs into fully functional myocardial cells. However, there currently are no tools for

researchers to confirm the successful differentiation of iPSCs into cardiomyocytes. Therefore, this project's goal was to create a tool that could be utilized by many researchers in studying the differentiation of human iPSCs to cardiomyocytes. This can be achieved by the coupling of GCaMP8 to the unique cardiomyocyte promoter  $\alpha$ MHC. GCaMP8 will only be expressed in cardiomyocytes, and when calcium is present it will bind to GCaMP8 causing a conformational change that will result in green fluorescence. This project was successful in creating the insertion plasmid,  $\alpha$ MHC-GCaMP8 - iCAG, that can be transfected into human iPSCs and differentiated into cardiomyocytes, which will display green fluorescence upon contraction.

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## Effect of Temperature on Nematocera Flying Population Dynamics

HYUN SEOK YOON

Under the supervision of Dr. David Winkler  
Department of Ecology and Evolutionary Biology

Abundance of flying insect is important for aerial insectivores as it is their food resource. To understand the dynamics of flying population of insects, I constructed a time-delay single population dynamics model for Nematocera as a preliminary step before studying it in a whole insect scale. The model's flow rates that describe various life cycle processes such as development, mortality, and reproduction, and flight proportion, are dependent on temperature. The model ultimately predicts adult population in flight with given temperature data, which is fitted to flight population sample data collected in Ithaca, NY. All 10 parameters in the model could not be estimated, so I attempted to estimate two parameters that are associated with development rate while fixing the other eight. The two estimated parameters were consistent to the estimates derived from experimental data from other literature. The estimated parameters produced simulated population that increased in early spring and curtailed at late summer. Perturbation analysis of each parameter showed that the effect of temperature on development rate and juvenile mortality rate had the biggest impact on population dynamics, while the effect temperature on flight proportion had the smallest impact. I also made a projection of the flight population with increased temperature pattern to understand its dynamics under a climate change regime. To portray the change in the temperature in Ithaca, NY due to climate change, I used the temperature patterns in locations in Southeastern United States. The projected flight population under climate change showed earlier outbreak, exponential growth throughout the growing season, and sudden drop at the end of the season. The exponential quality of the population curve became steeper as the added temperature was increased.

## Terrestrial Gastropod Gastronomy In Relation To Epiphytic Lichen Biodiversity and Abundance at Hubbard Brook Experimental Forest, Grafton County, New Hampshire

AILÍS B. CLYNE

Under the supervision of Natalie L. Cleavitt and Timothy J. Fahey  
Department of Natural Resources

Acid deposition has caused a decline in lichen communities which are sensitive to air pollution and substrate pH. However, acid rain has steadily decreased since the Clean Air Act of 1970 without an apparent resurgence in lichen populations. Several European studies have been conducted on the ability of terrestrial gastropods, particularly *Arion spp.*, to alter lichen community structure by way of herbivory. Terrestrial gastropods were surveyed at Hubbard Brook Experimental Forest (HBEF), New Hampshire from 1997 to 2006. We conducted a 10-year remeasure of gastropod densities for comparison. However, no data had been collected on the lichens of HBEF historically, so we conducted an initial baseline lichen survey of 13 plots. In addition, we created a scoring system to gather data on *in situ* grazing damage to lichen thalli and used it to assess the thalli of 49 plots. Furthermore, we conducted laboratory feeding trials comparing feeding preferences of non-native and native gastropods. Our findings show that *Arion spp.* (introduced to the United States from Europe) have a significant presence at HBEF and have potential to affect the community structure of lichen at HBEF and elsewhere. *Lobaria pulmonaria* may be especially affected as has been suggested in the literature.

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## The Dynamics of Diet Diversity in Dhalamokai: The Influences of Source, Seasonality, Perceptions, and Expense on Diet Diversity

SINAN-SALEH KASSAM

Under the supervision of Rebecca Stoltzfus  
Department of Nutritional Sciences

Many indigenous communities worldwide have faced a transition away from more traditional diets due to the new economy globalization has introduced. In this study we use diet diversity as an indicator to assess if this transition is influencing the health of the Irula community in the Village of Dallomokai in the Nilgiris Biosphere Reserve, India. We defined diet diversity as the quantity of different food groups present on the plate. We tested this by conducting interviews with households where we collected information on food being consumed and quantity, as well as access to different sources of food and seasonal influence on access. In addition, we collected information about perceptions of health and expense of source. We found that there is a diversity of food groups present. However, we found that the quantities are not equal. Cereals are making up the biggest portion of intake. Furthermore, when we found that the food grouping of cereals did not show much diversity and white rice was making up the biggest portion of the cereals being consumed. We found that animals, distance, lack of transportation, fatigue, and weather all make it difficult for community members to access the different sources of food. Our study also found that PDS and the market were

perceived as less healthy than the forest and the kitchen garden. In terms of expense, we found that the majority of households were spending Rs. 1000 on market food a week and Rs. 500 on PDS food a month. In conclusion, we were not able to state if the diet in Dallomokai was healthy or not, however our study provides important insight into pressing future studies on the status of diet diversity.

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## The Effect of Ethnic Fractionalization on Natural Resource Management and Economic Development: An Empirical Re-evaluation of the Resource Curse

CHAE MIN KIM

Under the supervision of Arnab Basu  
Charles H. Dyson School of Applied Economics and Management

Existing literature finds that ethnic fractionalization is negatively correlated with various development outcomes, including growth and public goods provision. This paper aims to explore the role of ethnic fractionalization on natural resource management and economic development in relation to the resource curse. I use the multiple imputation technique to account for missing values and perform hierarchical linear modeling on three levels. I also introduce several interaction terms to delineate the relationship among resource abundance, ethnic fractionalization, and institutional quality. Regression results from seven models conclude the following: 1) ethnic fractionalization negatively affects natural resource management, 2) resource curse is present in countries with weak institutions, but not in countries with strong institutions, 3) strong institutions can neutralize the adverse effects of ethnic fractionalization on economic growth. Given these results, this paper finds that there can be substantial economic gains from resource abundance and ethnic fractionalization by improving institutions.

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## Beech Bark Disease at the Hubbard Brook Experimental Forest, NH

MADÉLINE MONTAGUE

Under the supervision of Natalie L. Cleavitt  
Department of Natural Resources

The beech bark disease (BBD) complex (*Cryptococcus fagisuga* Lind., with *Neonectria* species) has caused widespread decline of American beech (*Fagus grandifolia* Ehrh.) trees in forests of eastern North America and continues to expand its range of influence. Effects of the BBD complex range from poor vigor and mortality of individual trees to forest-scale shifts in population structure, species composition and nutrient cycling. This study utilizes long-term demographic data from an extensively studied forested ecosystem, Hubbard Brook Experimental Forest in central New Hampshire, to predict landscape factors contributing to BBD severity and to characterize the demographic effects wrought by the beech bark disease complex. Results suggest that individual tree-level factors including size (diameter at breast height, DBH), canopy position and relative

growth rate are the best predictors of mortality. Both treelevel and landscape-level factors were significant predictors of BBD severity. BBD was worse on trees with greater DBH, dominant or codominant canopy status and on trees growing on low-elevation, eastern slopes that were less steep. An important result was the shifting size distribution to a forest with a coincident increase in abundance and decrease in size and stature of beech trees. These results corroborate findings by other authors relating the BBD complex to tree-level and landscape-level factors. Interestingly, these results suggest that the forest at Hubbard Brook, an important site of ecological study, has advanced to the 'phase of accommodation,' though it is frequently referred to as an aftermath forest by the scientific community. By establishing a baseline study of beech bark disease at Hubbard Brook this work enables future studies to assess the enduring effects of BBD, an important task at a Long-Term Ecological Research (LTER) site.

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## Response of Fine Root Biomass to Nitrogen and Phosphorus Addition in Young and Mature Forests in New Hampshire

DANNI QIAO

Under the supervision of Timothy J. Fahey  
Department of Natural Resources

Nitrogen and phosphorus are usually the most limiting nutrients to primary production in terrestrial ecosystems. As humans impose increasingly intense and frequent disturbances through excessive nitrogen emission, the health and dynamics of the forests are substantially affected; more broadly, the global nitrogen cycle has been accelerated and altered. Therefore, whether Liebig's law of minimum that the plant's growth is limited by the nutrient in least supply relative to the plant's requirement still holds applicable remains unknown. Especially in forest ecosystems, plants and microbes are so constrained by stoichiometry that the recycling of N and P have to be synchronized, which leads to N and P co-limitation. After the co-limitation equilibrium is disturbed by external forces, plants manage to maintain this balance through diverse energy allocation strategies. In order to investigate the impacts of anthropogenic activities and energy allocation mechanisms, we annually added N and P on plots in old and young northern hardwood forests and measured the fine root biomass. We found that young stands responded to N+P addition by significantly increasing the total fine root biomass, compared to control plots. Surprisingly, neither of the age groups showed any strong responses under only N or P addition plots. Our results demonstrate that due to the anthropogenic activities through excessive N emission, current young temperate hardwood forests have already shifted to a N and P co-limitation phase, and the conventional notion that terrestrial ecosystems are limited by one single element might not be appropriate. In order to further interpret fine root responses under co-limitation, future studies that include larger sample sizes among different age groups are needed; the next step of our study is to measure fine root growth using ingrowth cores.

## Field Characteristics and the Distribution of Wintering Field Birds in New York

CONNOR ROSENBLATT

Under the supervision of David Bonter  
Department of Natural Resources

Populations of open-field birds have been declining for decades in North America. Research has primarily focused on the breeding season, however, while wintering distribution and habitat selection are understudied. Research during the nonbreeding season may be especially important in northeastern North America, where reforestation is reducing the amount of open field habitat. In this study, I examined how the abundance of Snow Buntings (*Plectrophenax nivalis*) and Horned Larks (*Eremophila alpestris*) varied between agricultural fields of different cover types and sizes during the non-breeding season. I conducted repeated transect surveys in nine fields with different crop residues (stubble), a rapid, one-time survey of 99 fields of varying sizes and agricultural uses, and an analysis of eBird data examining the presence or absence of my focal species at a larger scale across New York State. The transect surveys revealed that both Snow Buntings and Horned Larks were more likely to be detected in corn stubble fields compared to pasture and hay fields. The rapid survey revealed no difference in detection probability of Snow Buntings related to cover types or field size, although no buntings were detected in fields smaller than eight acres. For Horned Larks, detection probability was greater in corn and soy fields compared to all types of grass fields, and detection probability was also greater in larger fields. The analysis of eBird data revealed that likelihood of occurrence for both species increases with the increasing percentage of open habitat in the surrounding landscape (500m radius). This study highlights the importance large field complexes where corn and other agricultural stubbles provide habitat and presumably greater food resources for open-field birds in winter.

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## Impact of Exotic Earthworms on Saprotrophic fungi *Lepista nuda*- A Novel Experiment

DANA SCHMIDT

Under the supervision of Bernd Blossey  
Department of Natural Resources

Saprotrophic fungi aid in the decomposition of wood and leaf litter on the forest floor, contributing to the organic horizon in the soil system. This organic horizon serves as a nutrient reserve and a chemical buffer in the soil system, among other things. Exotic earthworms feed on leaf litter and thus pose a threat to the biodiversity of soil microbes, including saprotrophic fungi. My research seeks to determine the impact of these exotic earthworms on the survival of saprotrophic fungal species *Lepista nuda*. I used three hardwood forests in New York where locations with and without earthworm had previously been identified (Dobson and Blossey 2015). I established inocula in containers using wood chips and allowed *L. nuda* to colonize the surrounding soil for 12 months. After retrieving samples, I used PCR and mycelium observation to assess presence/absence of *L.*

*nuda* and potential spread from the inoculum sites. Unfortunately, negative result for the positive control done on the PCR experiment led to that no definitive conclusion. My field observations indicated less mycelium was visible in areas where earthworms were present. This suggests that earthworms do have an impact on fungal distribution and provides a framework for future studies to investigate this relationship.

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## Landowner Perceptions of Water Quality in the Owasco Lake Watershed

GRACE KENNARD TUCKER

Under the supervision of Richard Stedman  
Department of Natural Resources

Although Owasco Lake is one of the smallest Finger Lakes, it has the third largest watershed in the region. Concerns about water quality in the Owasco Lake watershed have grown over time, as has the need to target conservation management practices for water pollution mitigation. This work assesses lakeshore property owners and dispersed rural landowners' perceptions, behaviors, and attitudes about water quality in the Owasco Lake watershed to create a more complete picture of water and land management and impacts at the watershed level. In total, 300 lakeshore property owners and 300 dispersed rural landowners were surveyed to evaluate stakeholder perspectives; the Drop-off/Pick-up (DOPU) method for survey sampling resulted in a high response rate of 74% for the lakeshore property owner sample and 53% for the dispersed rural landowner sample. This study depicts a watershed population that is highly disparate in terms of its socioeconomic makeup and land use preferences and yet remarkably united in its concern for its water resources. However, results indicate that lakeshore property owners generally have stronger pro-environmental attitudes and increased environmental awareness than dispersed rural property owners. Additionally, a number of residential and agricultural conservation practices are underutilized by landowners. Future management efforts should consider targeting specific populations within the watershed to improve water quality and conservation efforts. As a socioeconomic cross-section of a single watershed, this study provides much-needed insight in an area of the conservation practice adoption-diffusion literature that is relatively undeveloped and also expands the watershed disproportionality framework literature.

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## Thiamine Adsorption During Analysis and Optimization of Fish Egg Sample Preparation

NICOLE THUZAR TU-MAUNG

Under the supervision of Katie Anne Edwards and Clifford E. Kraft  
Department of Biological and Environmental Engineering and Department of Natural Resources

Thiamine, commonly known as Vitamin B<sub>1</sub>, is critical to the health and survival of living organisms, has implications for biogeochemical processes in both aquatic and terrestrial ecosystems, and

potential influence on the earth system at large. Thiamine is a critical co-factor in the metabolic processes across the tree of life. A diversity of pathways have evolved as adaptations to minimize energetic expenses and maximize the competitive advantage of organisms in the acquisition of this resource. Therefore, the availability of thiamine was an important factor in the evolution of many taxa. In its free form, thiamine is found at low concentrations in the environment as well as in plant and animal tissues. In order to better understand the role of thiamine in biological and environmental systems, it is critical to accurately estimate the amount of thiamine in samples of interest. Thiamine adsorbs to substrates as a result of cation exchange with different types of materials (Schmidhalter et al 1994). To optimize materials used in contact with thiamine during analysis, this study explores the amount and rate of adsorption of thiamine to various types of materials used during the analytical processes to optimize future thiamine related experiments. Thiamine samples were placed under a variety of conditions in contact with types of commonly used materials including glass and plastics. The adsorption of thiamine was tested in a practical context by simulating conditions required during the extraction thiamine from fish eggs. The amount of adsorption that occurred in each experiment was measured by oxidizing un-adsorbed thiamine after contact with materials through the use of potassium ferricyanide. The oxidized product, thiochrome, was then measured using a fluorescence reader. It was found that thiamine adsorption to glass provides severe limitations to thiamine analysis. Thiamine adsorption to plastics is low and the use of plastics is compatible with analysis in biological samples.

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## Gasoline Prices and Vehicle Fleet Fuel Economy

BINGLIN WANG

Under the supervision of Shanjun Li

Charles H. Dyson School of Applied Economics and Management

This study examines how consumers value the fuel costs relative to vehicle purchase costs when buying new vehicles in China, which is critical for evaluating the effectiveness of policy instruments, such as fuel taxes and vehicle taxes, in terms of raising fuel economy and correcting the negative environmental externalities. While there is a vast literature studying vehicle energy efficiency and the efficacy of related policy instruments, this has not been well studied outside the developed countries. In particular, China has become the largest automobile market in the world, and with the car ownership increasing over years, car emissions have become an important issue aggravating China's severe air pollution problem. The analysis is built on estimating a discrete choice model of consumer demand for differentiated products, which treats vehicles' fuel costs as one of many product attributes and maps individual preferences onto aggregate product sales. The estimation results indicate that consumers in China appear to value discounted future fuel costs only 74% as much as they value vehicle purchase costs and consumers in coastal developed provinces are more sensitive to fuel cost change, suggesting that the fuel tax should be targeting coastal developed regions. Counterfactual policy simulations find that the existing fuel tax and vehicle consumption tax significantly reduce the fuel consumption and raise the entire vehicle fleet fuel economy.

## Evidence for Crosswise Migration in a Nearctic-Neotropical Passerine Migrant

MAX WYTINSKI

Under the supervision of David Bonter  
Department of Natural Resources

Full life-cycle tracking of individual birds is required to understand linkages between breeding and wintering areas (migratory connectivity) and answer related questions about population dynamics and conservation. Yellow warblers (*Setophaga petechia*) are abundant, well-studied breeding birds in North America, but their migratory and non-breeding biology remains poorly understood. Previous research using genetic and isotopic techniques suggested parallel migration systems and identified longitudinal segregation among eastern and western breeding and wintering populations of yellow warblers, but this work had low spatial resolution. I tagged yellow warblers breeding in Maine and Wisconsin with miniaturized light-level geolocators, elucidating fine-scale migratory connectivity and determining fall migration timing, routes, and wintering locations of individuals of this species for the first time. Fall migration was leisurely for all individuals, lasting from 44-55 days with departures from the breeding grounds in late August and early September and arrivals at the wintering locations in late October and early November. The majority of individuals followed the east coast to peninsular Florida, then crossed to Central America before completing the final eastward leg of migration that brought them to northern South America. Yellow warblers breeding in Maine wintered in north-central Colombia, west of Wisconsin breeding birds, which wintered in Venezuela and the border region between Brazil, Colombia, and Venezuela. In addition to advancing knowledge of the migratory and non-breeding biology of the yellow warbler, my results provide an example of crosswise migration, a rare phenomenon in birds, and add to a growing body of knowledge related to the migratory and overwintering ecology of small Nearctic-Neotropical migrant passerines.

## Challenges of Adopting Sustainable Agricultural Methods in Contrasting Tropical Environments: Food Crops in Toliara, Madagascar & Coffee in Cauca, Colombia

SAARA SHANTI KUMAR

Under the supervision of Professor Julie Lauren  
Soil and Crop Sciences Section, School of Integrative Plant Science

This paper addresses the reasons why farmers show varying adoption rates of methods promoted by agricultural extension. It analyzes the context-specific obstacles that prevent farmers from adopting certain methods. This study looks at the effects of three types of factors on method adoption in two tropical environments: Toliara, Madagascar (semi-arid flat) and Cauca, Colombia (humid mountainous).

The factors analyzed were biophysical differences between farms, personal differences between farmers, and attributes of method promotion by extension. Data was collected primarily through farmer interviews. Biophysical factors such as slope, livestock, and farm size were negatively or positively correlated with method adoption depending on the environment. Livestock and farm size had opposite effects on method adoption in each of the sites. Personal factors such as parents' methods, trauma, religion, and risk aversion also impacted method adoption. Crop diversity and food security were correlated with greater method adoption in both sites. Attributes of extension correlated with adoption included method's testability, rapid and visual response, cost, and the degree to which a method addresses the overarching system constraint.

Recommendations for how extension can account for diverse constraints within target populations include increased emphasis on local capacity-building, less emphasis on reportable rates of adoption of donor-selected methods, and community-supported, sequential adoption to hedge individual risk. This need for sensitivity and adaptability to farmers' diverse and changing constraints will only increase as future factors such as climatic and technological change become reflected in the evolution of constraints and strategies employed by farmers across the tropics.

## Performative Ground: Climate Adaptive Site Design Strategies for the American Dance Institute – Lumberyard, Catskill, New York

GARRETT CRAIG-LUCAS

Under the supervision of Joshua F. Cerra  
Department of Landscape Architecture

In anticipation of sea-level rise and storm events of increased severity and frequency due to climate change, designers must develop a long-term vision for sites adjacent to water-bodies. Design for climate adaptation at the site scale requires a level of specificity and clarity that is not typically necessary at the community or city scale – it is where “the rubber hits the road.” This is to say that site design is where macro-scale adaptation strategies must now take physical form. It also involves engaging with specific land owners, and carefully incorporating their needs into design for climate adaptation at the human scale.

How can designers address the needs of program, community, and the local ecosystem simultaneously? Additionally, how can design enable sites adjacent to water bodies to function well under current conditions, periods of more frequent and more intense flooding, and ultimately when they are regularly inundated? The goal of this thesis is to understand the parameters defined by program and climate in a balanced way to develop methods for site design along urban waterfronts that will function well in both the short term and long term under a range of climate conditions. The American Dance Institute in the Village of Catskill will be the primary location for testing these methods in this thesis.

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## Facilitating Unconventional Design: Establishing a Living Waterscape in the Scajaquada Creek System

MARK J. HIRSCHBECK

Under the supervision of Maria Goula  
Department of Landscape Architecture

This design thesis is aimed at redefining the Scajaquada Creek system of Buffalo, New York into a working landscape that equally addresses the aesthetic and programmatic means of remediating site contamination over time through an unconventional, non-linear design process.

It will result in the first comprehensive plan for the city, allowing a regeneration and revaluation of an urban waterscape to return vitality and function to the area. The existing engineered hydrologic system is inadequate in handling stormwater runoff, pollution, and combined sewage discharge that regularly outlet into it, and is unfit for aquatic life after over a century of misuse. Upon becoming toxic, it has been dodged by city policy and hidden by the development of local highway I-98 (Scajaquada Expressway). However, it is located in an opportune location as a connective space between five completely different typologies (educational campus, historic public greenspace, vacant industrial, low

income residential, commercial mixed-use), and was one of the original inspirations for Olmsted in establishing the Buffalo park and greenway system, creating profound potential for future use.

My proposal derives from a comprehensive analysis of site conditions and history, pairing a section transect narrative with diverse mapping strategies. I am examining the creek morphology, geology, historic shorelines, dissolved oxygen and fecal coliform rates, flow patterns, edge conditions, emergent ecology, and peripheral land use to reach a site-specific, criteria-based design framework with the aim of providing a vision for a series of critical actions that will create a new collective landscape for Scajaquada Creek.

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## EcoDistrict Approach to Neighborhood Planning: Successes, Lessons Learned, and Implications for Nurturing Social Resilience

IVY WONG

Under the supervision of Joshua F. Cerra  
Department of Landscape Architecture

Neighborhood planning's origin coincides with the emergence of urban planning as a profession. With the rising importance of sustainability in recent decades and the emergence of the 'eco-urbanism' planning movement, an organization called EcoDistricts aims to reconnect people with nature through district or neighborhood-scale planning. The EcoDistrict Protocol for planning and implementation of sustainable neighborhoods, called ecodistricts, heavily emphasizes collaborative governance between government, civic organizations, and the private sector, as well as performance metrics as indicators for success. It also requires ecodistricts to commit to three imperatives of equity, resilience, and climate protection. I used a case study method to compare how five ecodistricts framed their approach to planning, with respect to these emphases. I synthesized the successes, difficulties and lessons learned from each respective planning approach. Each of these ecodistricts represented a diverse set of characteristics in terms of process, socioeconomic conditions, neighborhood compositions, and stakeholder audiences. However, the interviews and case-study comparisons revealed a common set of patterns and implications for neighborhood planning, including A) most planning projects are still top-down, B) the difficulty of engaging the three key stakeholders, C) the difficulty of addressing social resilience while increasing economic development, D) difficulty of engaging the community and increasing ownership of residents, and E) difficulty of gaining trust from stakeholders. It also reveals that although the EcoDistrict Protocol proposes performance metrics and collaboration that can be effective when implemented successfully, there is a lack of emphasis on social resilience and guidelines for community engagement which deserve further incorporation in future protocols. If incorporated, the protocol could become a powerful tool for building resilient communities.

## Nickel Catalyzed $\alpha$ -Olefin Polymerizations for Access to Renewable Polar Polyethylene

AHMED M. AHMED

Under the supervision of Geoffrey Coates  
Department of Chemistry and Chemical Biology

Polyethylene is an attractive material because it is inexpensively produced, and has an extremely wide range of applications. It is used to make films, containers, bottles, buckets, and more. Unfortunately, this dynamic material is currently accessed through fossil fuels, a source that depletes over time. Thus, the ability to access this material through renewable sources is of great interest. In this study, a new tert-butyl aryl-naphthyl-Ni(II)- $\alpha$ -diimine catalyst was synthesized and shown to have remarkable behavior for the chain-straightening polymerization of 1-decene to produce “polyethylene” type materials. The catalyst produced high molecular weight poly(1-decene) with narrow dispersity, and higher melting temperature than those made by related Ni(II)  $\alpha$ -diimine catalysts. Furthermore, the tert-butyl catalyst was able to copolymerize 1-decene with 10-undecenoic acid (as well as methyl 9-decenoate), to yield semicrystalline, carboxylic acid (or ester) functionalized “polar polyethylene” from biorenewable sources.

## “Expressing your Lethal Colors: A Study on the Environments Which Induce the Expression of the Salmonella Cytolethal Distending Toxin”

MIQUELA L. HANSELMAN

Under the supervision of Dr. Martin Wiedmann  
Department of Food Science

Recently, it was discovered that select nontyphoidal serotypes of Salmonella produce the Salmonella cytolethal distending toxin (S-CDT). The cytolethal distending toxin (CDT) is a toxin produced by multiple Gram-negative pathogens. S-CDT is made up of three subunits, PltA, PltB and CdtB. S-CDT induces DNA damage which causes eukaryotic cells to arrest in the G2/M phase and the nucleus of these cells to distend. The goal of this study was to characterize the transcriptional regulation of S-CDT for the nontyphoidal Salmonella serotype Javiana. This study characterized the expression of six different genes- *pltA*, *pltB*, *ssaG*, *cdtB*, *STY1887*, and *ttsA*, in two different strains grown in lysogeny broth (LB). All genes in the S-CDT operon were expressed when the strains were cultured in LB broth. Deletion of a key regulator of Salmonella pathogenicity island 2 (SPI-2) did not result in decreased transcript levels of S-CDT genes, suggesting that S-CDT and SPI-2 are not co-regulated.

## Trends in the Frequency and Duration of Extreme Temperature Swings in the Eastern United States

LI-SHA LIM

Under the supervision of Dr. Arthur T. DeGaetano  
Department of Earth and Atmospheric Sciences

While trends in extreme temperature occurrences have been extensively studied, swings in extreme temperatures have not been explored in detail. Focusing on the eastern United States, this study seeks to spatially, temporally and statistically quantify trends in the frequency of extreme temperature swings and the duration between these swings. We utilize a subset of 232 stations from the U.S. Historical Climatological Network (HCN), with daily temperature data spanning from 1900 (or earlier) to June 2016. Unlike previous studies, we conduct our analyses on data averaged over 7, 15, 30, 60 and 90 days respectively, enabling us to analyze the impact of short- and long-term synoptic weather patterns on observed trends. To study regional trends, we further divide the climate stations into the Northeast, Southeast and Midwest.

Using fixed thresholds of the 5th and 95th percentiles to identify extreme temperatures, we found that the frequency of temperature swings has recently been decreasing. Decadal averages for June 2006 to June 2016 are the lowest on record since 1896 and temperature swing durations have peaked. This finding, however, is limited to averaging intervals of 30 days or less. Analyses conducted on detrended temperature data reveal similar trends, hinting that synoptic scale features such as jet streams (instead of climate change) might be the cause. Time frames of 60 days or longer yielded inconsistent results. Comparisons between regions suggest that the Southeast has the highest percentage of stations seeing a decline in extreme temperature swing frequency, followed by the Midwest and then the Northeast.

## Response of soil microbiomes to alterations in soil phosphorus levels and consequences for alfalfa (*Medicago sativa*) growth

LAURA M. KAMINSKY

Under the supervision of Dr. Jenny Kao-Kniffin  
Horticulture Section, School of Integrative Plant Science

Sudden shifts in soil phosphorus (P) levels are common in agricultural systems relying on P fertilizer applications. However, little is known of the resiliency of soil microorganisms to changes in P pools and the effects on their plant hosts. In this experiment, we investigated how P amendments affected soil microbial composition in reference to *Medicago sativa* growth. A common starting microbiome was selected for the emergent phenotype of high *Medicago sativa* biomass under four different soil P amendment treatments: control (no P amendment), organic P (compost amendment), low inorganic P (moderate triple superphosphate (TSP) amendment), and high inorganic P (high TSP amendment). Following four generations of planting and selection, microbiome composition and hydrolytic enzyme activity was distinct in each treatment. Microbiomes from each nutrient regime were then reciprocally transplanted across all nutrient conditions, which caused most microbiomes to converge and resemble each other in the same contemporary soil conditions. The exception was microbiomes from the high TSP treatment, which maintained a unique compositional footprint in other soil treatments. Correspondingly, *Medicago sativa* grown with the high TSP microbiome had lower biomass, fewer nodules, and lower %N than plants grown in the same soil with other microbiomes. These findings suggest that chronic or excessive inorganic P fertilization may have a legacy effect on soil microbiomes that inhibits their ability to support plant growth.

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## Transcriptional Regulation of Drought Induced Stomatal Closure in the Maize Nested Association Mapping Population

JEREMY D. PARDO

Under the supervision of Edward S. Buckler and Taryn L. Bauerle  
USDA ARS & Plant Breeding and Genetics Section, School of Integrative Plant Science; and  
Horticulture Section, School of Integrative Plant Science

Optimal stomatal conductance under drought is a balance between maximizing CO<sub>2</sub> assimilation necessary for photosynthesis, and prevention of water loss. The transcriptional control of stomatal closure is critical in regulating this balance. To further our understanding of differential stomatal behavior and transcriptional response to drought, we conducted an experiment where we withheld water from three-week old seedlings of the 27 maize Nested Association Mapping (NAM) founder lines in a greenhouse experiment. We measured stomatal conductance for three days following drought stress initiation. We identified significant differences in stomatal conductance of over 100  $\mu\text{mol M}^{-2} \text{S}^{-1}$  under drought stress among the NAM founders. To detect genes correlated with stomatal behavior during drought, we constructed 3' RNAseq libraries from leaf tissue collected one

and three days after drought initiation as well as from well-watered controls on each day. We identified 1032 genes differentially expressed between control and drought conditions after one day of drought stress and 10,194 genes differentially expressed after three days of drought stress. Among the differentially expressed genes we found significant enrichment for ABA response genes. We also examined transcription factors significantly correlated with stomatal conductance and found 30 that were also differentially expressed under drought stress.

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## Soil Seed Banks on Four Organic Grain Crop Farms in Central New York

KIRBY T. PETERS

Under the supervision of Matthew Ryan  
Soil and Crop Sciences Section, School of Integrative Plant Science

Knowledge and understanding of weed populations and communities in organic agriculture can be used to optimize weed management practices and strategies. The objective of this study was to quantify the soil weed seed bank and characterize the weed community on organic grain crop farms in central New York. Specifically, we were interested in the range of weed populations, weed community composition and species richness, and the abundance of red clover, which is often grown as a cover crop or forage crop. This research was conducted in collaboration with four certified organic grain crop farmers in central New York in 2015 and 2016. Each farmer selected three fields for this experiment: a 'Clean' field (i.e., low weed population), a 'Weedy' field (i.e., high weed population), and a 'High clover' field (i.e., high red clover population). Soil samples were collected from each field and a greenhouse germination bioassay was conducted to quantify the density of emerged seedlings by species. Weed seed bank densities across all fields ranged from 3,847 seedlings  $m^{-2}$  to 103,005 seedlings  $m^{-2}$ . A total of 97 plant species were found across all fields and farms. The majority of fields contained red clover in the soil weed seed bank. Red clover seed bank densities across farms ranged from 318 seedlings  $m^{-2}$  to 2,851 seedlings  $m^{-2}$ . Purslane speedwell, giant foxtail, common ragweed, pigweed species, woodsorrel species, and common lambsquarters were common species across the majority of the farms. The results provide evidence of red clover seed banks and support organic farmer's observations that red clover persists as a volunteer crop after tillage.

## Broadcast News Media Framing of Police Officers in the United States from August 2013 to August 2016: Before, During and After the Death of Michael Brown

EMILY AKPAN

Under the supervision of Jeff Niederdeppe  
Department of Communication

Around midday on August 9, 2014 in Ferguson, Missouri, eyewitnesses spotted a conflict between Michael Brown, an 18-year-old black male, and Darren Wilson, a white police officer (New York Times, 2014). According to Wilson, Brown fit the description of a suspect in a store theft nearby, which caused him to stop his SUV and engage with Brown. Wilson claimed that Brown “reached into the vehicle and fought for his gun,” while other witnesses reported completely different observations.

In the months since Michael Brown’s death, police-civilian relations became a major, widely-covered topic in the news media. News media, either directly from a news source or indirectly via social media, remains a major source of information for the US public. In communication research, the way the media portrays and reports on an issue is known as media framing. Through the application of media framing theory, this thesis project will assess (1) if and how the portrayal of police on major news broadcasting platforms changed in the aftermath of the Ferguson shooting, and (2) whether the nature of police-related coverage in recent years (before and after the Ferguson shooting) differed between Fox News (a right-leaning outlet), CNN (a more centrist outlet), and MSNBC (a left-leaning outlet).

Additionally, this paper aims to build on existing research about news media framing of police officers. Following the shooting of Michael Brown I perceived, in my own media use, an influx of media content about police. To assess the degree of generalizability of my own experiences and perceptions, this project uses a thorough and systematic content analysis to analyze broadcast news media coverage of police.

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## Judging Academic Achievement and Success After College: Effects of Median Grades on Transcripts

ELI B. BIENSTOCK

Under the supervision of Jonathon P. Schuldt  
Department of Communication

There is a policy in place at some universities, including Cornell, in which undergraduate transcripts must include the class median grade alongside the grade earned by the student. The present research attempts to understand how third-party viewers, such as graduate admissions representatives or employers, judge these so-called “enhanced transcripts”—and in particular, how perceptions of academic achievement and success after college are affected when the perceiver is given a standard

of comparison, in this case, the class median grade. In a between-subjects survey experiment with three conditions,  $n = 197$  participants were asked to judge a student's semester transcript that depicted grades that were either higher than the median (positive condition), lower than the median (negative condition), or that were depicted without the median grade (control condition). The student's course grades were identical across conditions; only the median grade information was varied. Results showed that having grades above the median influenced participants to positively perceive that student's academic achievement while having grades below the median had little effect on participant's perceptions of academic achievement and later success. This may be due to what might be called the "George W. Bush Effect," in which "C" students at elite universities are still perceived as well positioned for success. Examining other key variables, such as quality of the institution and the perceiver's own academic achievement (e.g., GPA), and their relationships to perceptions about academic achievement may yield implications for policy and future research.

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## Understanding the Linkages Between Mental Health Experiences & Race Among United States College Students

RUTH ENRIQUEZ

Under the supervision of Sarah Giroux  
Department of Development Sociology

In recent years, mental health and how to support those with mental health disorders have become popular topics of discourse for Americans. In the United States, 17.9% of the population is affected by some mental health illness. In this thesis, I explore the linkages between racial and ethnic minority status and views on, and experiences of, mental health disorders. In particular, I chose to focus on this question at college campuses, as previous literature has both noted the importance of mental health issues in college completion and also the significant variation in college completion by race. Using data obtained from the American College Health Association I find a clear dissonance between racial and ethnic minorities' curiosity and interest in receiving information about Anxiety and Depression and their actual receipt of mental healthcare. In order to better understand that relationship, qualitative data was sought through the medium of generates through focus groups conducted with minority students at Cornell University. This group, which included the testimonies of Black and Asian minorities, emphasized the notion that that mental healthcare was "not for racial and ethnic minority students" but rather only for "rich white people." They reported a stigma and misunderstanding of mental health in their communities they believed surpassed that of white communities, controlling for low income status. This thesis highlights the importance of developing mental health programs on college campuses that specifically place a greater emphasis on serving racial and ethnic minority communities.

## How Youth from Disadvantaged Populations Attribute Sponsorship and Perceive Credibility of the Source Behind Cigarette Graphic Warning Labels

MIA JOVANOVA

Under the supervision of Sahara Byrne  
Department of Communication

In 2009, the U.S. Federal Drug Administration, currently responsible for the regulation of tobacco products, proposed 9 cigarette warning labels without an identified sponsor. However, few studies have examined if or how sponsorship, or lack thereof, matters on cigarette warning labels. This study explores how sponsorship endorsements on graphic warning labels influence source attribution, recall, and perceived credibility among a population of 6th-8th graders (N=119) residing in primarily disadvantaged communities. In a randomized between-subject experimental design, youth were exposed to graphic warning labels with manipulated sponsorship (Federal Drug Administration, American Cancer Society, or no sponsor). Among participants in the no sponsor condition (n=40), 82.5% misattributed sponsorship to a source other than the FDA, including 27.0% to a non-existing public health organization and 22.5% to a cigarette company. Only 38% of those exposed to FDA or ACS endorsements (n=79) correctly recalled the respective government and public health sponsor depicted on the label. Exposure to packs with and without a sponsor logo, and correct recall of an identified sponsor did not lead to significant differences in credibility judgments. Instead, perceived sponsor attributions, or who the youth thought sponsored the label, predicted significant differences in credibility judgements ( $p=0.023$ ). Misattribution that a cigarette company sponsored the warning labels lead to more negative credibility perceptions compared to government/public health agencies.

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## Purple Protectors: The Effect of Increased Presence of Legal and Advocacy Services on Incidences of Domestic Violence

SAMANTHA JANE KREDA

Under the supervision of Thomas Hirschl  
Department of Development Sociology

Domestic violence is a serious issue that afflicts people from all genders, classes, religions, ethnicities, and sexual orientations. Abusers use coercive methods to gain control over their victims, which has the potential to lead to a lasting cycle of domestic violence and all of the negativity that comes along with it. This thesis plans to explore the various institutions related to aiding victims of domestic violence and the efforts that they have made to better the climate that can protect them from the abuse that they experience. The qualitative research that I plan to conduct will force the institutions to self-reflect on the efforts of their agency, to comment on the development of policies and practices over time, and to express their opinions of other institutions' efforts to aid victims of domestic violence. I am primarily interested in exploring domestic violence because of my experience working with the Special Victims Bureau at the District Attorney's office in my county, helping with the preparation for domestic violence cases. The types of cases that I was able to work

on ranged from physical violence to emotional violence to anything in between, often being a combination of multiple types. By better understanding what role the police can play for victims of domestic violence, both from the viewpoint of the police and those in charge of domestic violence services, I will be able to better determine the impact that law enforcement has on the victims and the rates of reporting among domestic violence cases. Through this research, I hope to be able to offer policy resolutions and agency suggestions to better the climate for victims.

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## An Explorative Analysis of the Native American Health Experience: Behavioral, Clinical and SES Influence on Poor Health and Premature Death

ROBERT PLUMMER

Under the supervision of Tom Hirschl and Sarah Giroux  
Department of Development Sociology

### Motivations for Native American Health Research

Dr. Holden, an ER physician of Montefiore Medical Center and CEO of the Non Profit Organization Mentoring in Medicine, embarked on a trip to the Native American Crow reservation for a healthy living initiative. This was targeted at students of Hardin High school in Montana during the Fall of 2015. A medical student by the name of Simone, who accompanied Dr. Holden on her trip recounted her experience at the reservation to me. She reported seeing a complete disregard for the gargantuan, state of the art and untouched Northern Cheyenne Medical Hospital stationed in the center of the reservation. She stated “There were absolutely no physicians or patients in the hospital,” evidenced by her tour throughout the hospital that revealed empty hospital beds, Emergency Rooms and Operating Rooms. An even more astonishing realization was the Fried Chicken conglomerate KFC located a short walk “up the hill from the hospital which functioned as more of a museum than a medical clinic.” Some may assume that strict cultural customs of the Native Americans, would cause a predictable rejection of western medicine, culture, food and ideals. However, this very assumption contradicts the twice as prevalent rate of cardiovascular disease in Native American when compared to the general population (Howard et al.1999) which is highly correlated with consuming “red meats, high-fat dairy products” and or fully Americanized foods like KFC (Teresa T Fung, et al. 2001).

The Juxtaposition of western health and western food on the Crow reservation, reveals the sociobehavioral and socio clinical intricacies of the American Indian state of health. Dr. Holden recounts in conversations with Native American tribe elders that “although the Native American philosophy on medicine is focused on restoring balance and ridding the body of bad spirits believed to be the root cause of a disease, they are certainly not opposed to incorporating Western medicine into their practices. What keeps the crow reservation hospital empty is the inability to “bridge the gap between long standing Native American tradition and the knowledge of Western Medicine.” (Doctor Holden) This is exemplifies the dire impact of behaviorally ill equipped health clinics and shortages of ethnically diverse physicians willing to live and stay on the reservation while culturally identifying with the patients. A certain level of sensitivity and adherence to governing social behaviors is required to bridge cultural gaps, for example in some Native cultures, direct eye contact

may be considered disrespectful. A complete avoidance of the Northern Cheyenne Hospital was no mistake, and hopefully this research can shed light on the determinants of this peculiar

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## Family Planning in Pakistan: Is stagnation Inevitable? The Effect of Individual and Community Factors on Family Planning Use

SONYA QAMAR

Under the supervision of Alaka Basu and Sarah Giroux  
Department of Development Sociology

Despite nearly six decades of initiatives and programs aimed at addressing rapid population growth, high fertility rates and low contraceptive prevalence rates (CPR) persist throughout Pakistan. Although the utilization of family planning may seem very attainable, approximately 225 million women globally lack safe, effective, and efficient methods of family planning. This is especially true in Pakistan, whereby only 26 percent of women are utilizing *modern* contraception. This topic is of great importance because family planning is a critical instrument in addressing and reducing population growth and in bettering individual and family economic and social wellbeing. Most of all, it is a crucial element in giving women the power to control their own reproductive lives and their sexual and reproductive health.

With a population of nearly 193 million people (2016), Pakistan is the sixth most populous nation in the world. This is of great concern to many considering Pakistan's many failed efforts to reduce its fertility rates. It is with this motivation that this research will explore how individual and community/contextual factors such as income, educational attainment, religion, marriage, empowerment/decision making power and personal perception have impacted family planning uptake and contraceptive usage in Pakistan. Through a thorough analysis of literature on this subject, this paper will examine the ways in which Pakistan's historical, political, and social contexts have influenced the course of family planning initiatives, as well as the ways in which such factors have impacted individual use of family planning. Using a multilevel logistic regression, I will draw upon the 2012-13 Pakistan Demographic Health Survey to model the statistical relationship between individual and community factors on contraceptive use, and will explore sociocultural trends that have impacted uptake.

## Transformative Engagement, An Ethical and Narrative Exploration of the University-Community Engagement Project and its Alternatives

LUCY DEAN STOCKTON

Under the supervision of Scott Peters  
Department of Development Sociology

In Ithaca, Cornell is a contentious lamented as an institution isolated from and exclusive of its neighboring communities, but its effect is not limited to neutrality. Rather it affects Ithaca in the extreme, in both positive and negative ways. Cornell employs a larger amount of people than any industry in Western New York, in addition to being the largest landowner. As a non-profit, it pays no taxes and instead, as part of institutional agreements, pays voluntary settlements to the city, and comparatively far less than its peer institutions. In recent years, the housing crisis in Ithaca has continued to be exacerbated by student demand, a monopoly on landlords, and the Cornell administration's unwillingness to provide more university housing. Beyond overlapping geography, there are other social forces at play that construct a hierarchical relationship, wherein Cornell is an oft-demonized, exclusive institution that considers Ithaca's well-being secondary to its own, and contributing to the division between the two communities. These dynamics are largely documented through anecdotal experience and in local news.

Framing Cornell as a benefactor and the communities it works with as beneficiaries, or infamously "takers," erases the nuance and ignores the complex historical dynamics and underlying tensions that exist today. There is significant criticism of these relationships as they are, in both the literature and in practice, and the work of university-community relationships, service-learning and engaged scholarship is naturally self-reflective work, encouraging criticisms within the discipline and allowing space for innovative and genuinely equitable partnerships, that challenge the geography of the dynamics characterized above. In an effort to accurately depict the landscape of community engagement today, I will be documenting and exploring these works, but ultimately, I seek to explore the moral and ethical foundations of these relationships through story and case study.

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## The Effect of Networked Phenomena on Lifestyle Politics Honors Thesis

RYAN TORRIE

Under the supervision of Michael Macy  
Department of Information Science

Both popular experience and data from the General Social Survey (GSS) suggest that people coalesce into groups that have similar demographic attributes and ideologies, and that these group correlations extend into the realm of lifestyle preferences. We hypothesize that this phenomenon is partially because people change their opinions to match previously displayed beliefs from members of their "in-group". To investigate this hypothesis, we placed participants into groups of eight, according to age (over or under 30 years old), and sequentially asked them for their (yes/no) opinions on lifestyle metrics. We

present evidence that people follow arbitrary signals (in this case, agreement or disagreement with statements taken from the GSS) from members of their in-group, creating incipient “opinion networks” that are carved out by forces of social influence. This research is meant to partially explain the willful lifestyle segregation that is so pervasive in modern society. It also lends credence to the claim that strong correlations between socio-political identities and lifestyle habits aren't directly causal, but rather mediated by networked events.

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## Luck of the Draw: An Exploration of Methods to Predict and Deter Online Deception

CHRISTOPHER J. TRAVER

Under the supervision of Natalie Bazarova  
Department of Communication

Detecting deception is difficult. Is it possible to predict or modify the likelihood that a person will choose to deceive? In this experiment, we conduct a study that investigates how surveillance primes, accountability, incentives, risk aversion, conscientiousness, and mood can affect deception by using a paradigm in which participants report the result of a rolling of a die in an online environment. The resulting responses were compared to a known truth, and analyzed for deviations from what was the right number per the experimental setup. We asked participants on Amazon Mechanical Turk to roll a virtual die three times and report the numbers rolled. The participant's location, an image of eyes, or an image of flowers (control) was presented during the reporting phase. In all conditions, participants were offered a larger amount of money for a higher reported result. In certain conditions, participants received higher incentives compared to others. The results revealed that when participants received lower numbers on their die rolls, they became more likely to lie, while participants with high risk aversion and less experience on Amazon Mechanical Turk lied less often. We also discovered that mood generally decreased across all participants, and those who lied experienced a significantly worsened mood compared to those who didn't lie.

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## Virtual Reality and Opinions

AISHWARIYAH DHYAN VIMAL

Under the supervision of Andrea Stevenson Won and Michael Shapiro  
Department of Communication

A number of studies have shown that users' activities, for example cutting down a tree (Ahn, Bailenson and Park, 2014) and users' appearance, for example as an elderly person (Yee, 2006) in virtual reality can influence user's attitudes and behaviors. One possibility that has not been explored is whether a VR user's actions and appearance can influence their support for public policies.

This study in particular explores whether shopping for groceries as either an avatar with a normal or an obese body in a virtual grocery store in a neighborhood with limited choices of healthy food (a food

desert) can influence the participant's support for public policy about obesity. Such policy would encourage the establishment of farmers' markets, grants to independent grocery stores to sell healthy products in locations where supermarkets are not present, and incentives for full-service grocery stores to open locations in areas with limited access to healthy goods (Frieden, Diets, & Collins 2010; Khan et al., 2009).

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