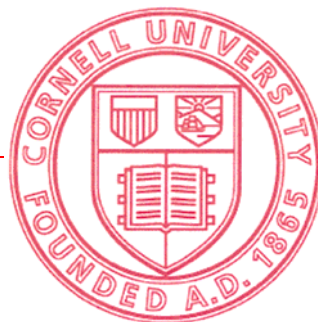


# College of Agriculture and Life Sciences

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**2008—2009**

## **Research Honors Program Abstracts**





**W**ith an academic mission that embraces four areas of great importance to life in the 21<sup>st</sup> century—our land grant mission, the applied social sciences, the environmental sciences, and the new life sciences—the College of Agriculture and Life Sciences offers an extraordinary range of research opportunities to the committed undergraduate. Many students consider the research they undertake as undergraduates in CALS to be the most challenging, enduring, and valuable experiences of their time at Cornell.

The students who sought to undertake the research projects described in this booklet and thereby earn a bachelor's degree with honors have demonstrated an impressive capacity for mature scholarship and intellectual growth. With some very special faculty expertise, academic resources, and research facilities to support them, they have conducted original research and examined some of the most pressing and relevant questions of our time.

In our increasingly global community, many people are faced with significant issues involving food security, environmental health and safety, communication, political strife, and economic hardship. Our college is dedicated to tackling these issues and others through basic and applied research, teaching, and outreach that advance knowledge, develop leaders, and improve lives. Our contributions to the people of New York State, the nation, and the world are very substantial indeed.

I am extremely proud of our undergraduate students and their achievements, and I wish them the very best in their future endeavors. I am also proud of the dedicated faculty who supervised these honors research projects and mentored these students to their fullest potential. These new graduates will take their places among tomorrow's leaders. As you will see in reading about their research, they give us reason to hope for a better future for all.

Susan A. Henry, Ph.D.  
*The Ronald P. Lynch Dean of  
Agriculture and Life Sciences*

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## The Effect of Supplemental Phytase on Iron Bioavailability to Weanling Pigs in a Wheat-based Diet

ADAM E. ALMARAZ

Under the supervision of Dr. Xingen Lei  
Department of Animal Science

Two experiments were conducted to investigate the effect of supplemental dietary phytase on intrinsic Fe bioavailability in a wheat-based diet fed to anemic weanling pigs. Previous work has shown that supplementing phytase in corn-soybean based diets improves iron bioavailability in the pig model. In Experiment 1, pigs were either fed an iron deficient basal diet or the basal diet supplemented with 2,000 phytase U/kg of feed. In this experiment, weanling pigs had access to a commercial creep feed prior to being fed the experimental diets, and the pigs were initially less anemic than pigs in Experiment 2. Supplemental phytase had no apparent effect on intrinsic iron bioavailability in Experiment 1. In Experiment 2 pigs were fed an iron deficient creep feed and weaning diet prior to being fed one of three experimental diets. In Experiment 2, pigs fed the iron deficient basal diet had lower growth performance, packed cell volume, and blood hemoglobin concentrations than pigs fed the basal diet supplemented with 2,500 phytase U/kg of feed, or the basal diet supplemented with inorganic iron at 40 mg/kg of feed. Phytase supplementation in a wheat-based diet appears to improve intrinsic iron bioavailability, and appears to correct iron deficiency as effectively as supplementing a source of inorganic iron in swine diets. These results highlight the necessity for using sensitive models when investigating nutrient bioavailability. The ability for phytase supplementation to provide an alternative means for preventing and correcting iron deficiency warrants further research.

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## Prevalence of Pawing Behavior in Standardbred Racehorses

CHRISTINA L. BUTLER

Under the supervision of Dr. Katherine Houpt  
Department of Clinical Sciences

This study investigated the prevalence of pawing behavior in Standardbred racehorses. A population of 41 currently racing Standardbred racehorses was observed twice daily for a period of two months to determine if there was a relationship between pawing and sex, gait or time of day. Twenty-four of the 41, or 58.5 percent of observed horses showed pawing behavior at the time of observation. The group of horses which showed the pawing behavior consisted of eight females and 16 males. Observations of pawing ranged from 0.83 percent to 31.4 percent of total observations with the average percentage of pawing observations at 10.6 percent of total observations. The majority of pawing observations were recorded in the afternoon with an average number of 79.8 percent occurring in the afternoon, while an average of 20.2 percent of pawing observations occurred in the morning. These findings indicate that greater than half of the observed population of Standardbreds exhibited pawing behavior, and within the pawing group the majority showed significantly more

pawing behavior during the afternoon observation ( $P < 0.05$ ). These results have important implications for future studies investigating stereotypic behavior not only in horses, but across species as well.

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## Interactions between Host Genotype and Bovine Papillomavirus in Equine Sarcoid

JENNIFER M. CASSANO

Under the Supervision of Dr. Douglas Antczak

Baker Institute for Animal Health and Department of Microbiology & Immunology

Sarcoid is a skin tumor that is the most common neoplasm of horses. It is a problem for horses and horse owners because while the tumor is usually non-malignant, it often develops on parts of the horse interfering with its use, it manifests itself in many ways, with six defined presentation types, and sarcoid can be difficult to treat. The response to treatment is quite variable, from spontaneous regression to reemergence of the tumor after efforts such as surgical removal, cryotherapy, immunotherapy, and interstitial brachytherapy. This study focuses on two aspects of sarcoid, the association between Bovine Papillomavirus (BPV) types and sarcoid, and the association between sarcoid and certain Major Histocompatibility Complex (MHC) haplotypes. In the 15 horses with sarcoid I tested, 9 horses had BPV 1 and 5 horses had BPV 2 across various breeds. In the sarcoid population sample, there was an overrepresentation of microsatellites located in the MHC region associated with the A3 haplotype. The strongest association was found in the UM011 Class II microsatellite; every sarcoid bearing horse had microsatellite lengths associated with the A3 haplotype. This work confirms previous studies which demonstrated that BPV types 1 and 2 are both found commonly in the United States, while in Europe BPV type 2 is rare. It also extends virus information and demonstrates a preliminary ratio of virus types. The study appears to identify a new way to look at the genetic association between sarcoid and MHC haplotypes, using molecular techniques rather than serological methods.

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## Relationship between Fecal Score and Oocyst Shedding in Dairy Calves Challenged with *Cryptosporidium Parvum*

MEAGAN A. COONEY

Under the supervision of Dr. Daryl Van Nydam

Department of Population Medicine and Diagnostic Sciences

*Cryptosporidium parvum* is a zoonotic protozoan parasite commonly infecting dairy calves less than 30 days old. Infected animals display symptoms of diarrhea and shed approximately 10<sup>7</sup> oocysts / gram of feces. The objective of this study was to determine if there is an association between observed fecal score and oocyst shedding. A double-blinded, randomized trial was conducted using Holstein dairy calves. One of the study personnel was present at all births to transport calves to isolation barns where they were housed for 42 feedings (21d). Calves received 4L of colostrum during their first 12 hours of life and were inoculated with 1.0 x 10<sup>6</sup> oocysts of *C. parvum* 1-3 hours

after the second feeding. Fifty three calves were enrolled in the study (four lost to follow up) and randomly assigned to one of two treatment groups (group 1, n= 25; group 2, n= 24) of a proprietary prophylactic. Each treatment group was analyzed independently. Fecal scores were assigned at each feeding on a scale of 1 to 4, with the higher number indicating increased severity of diarrhea. Fecal samples were collected once daily and analyzed for the presence of *C. parvum* oocysts using the Merifluor Crypto/Giardia immunofluorescence antibody assay. Normal excretion patterns of *C. parvum* were observed and results showed that both treatment groups had a statically significant relationship between the number of oocysts shed in normal feces versus diarrhea. There was no statistical difference in either group for the number of oocysts shed in mild versus severe diarrhea, although the mean number of oocysts shed was increased.

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## The Effect of Caffeine, Thimerosal and Thapsigargin on Stallion Sperm Hyperactivation

MATTHEW F. GALATI

Under the supervision of Dr. Sylvia Bedford-Guaus  
Department of Clinical Sciences

Ejaculated mammalian sperm become fertilization-competent after undergoing physiological changes in the female's reproductive tract, namely capacitation and hyperactivation. The latter is characterized by a change in sperm motility from symmetrical flagellar bends to vigorous, asymmetrical, high-amplitude flagellar bends, with the pattern of motility being species-specific. The main trigger responsible for the initiation of hyperactivated motility is an increase in intracytoplasmic  $Ca^{2+}$  arising potentially from both intracellular and/or extracellular sources. Therefore, pharmacological reagents that increase intracytoplasmic  $Ca^{2+}$  have been used to induce hyperactivation in sperm from a variety of species. Recently, hyperactivation has been characterized for stallion sperm using procaine treatment, a reagent hypothesized to increase membrane permeability to extracellular  $Ca^{2+}$ . Since hyperactivation of stallion sperm is crucial for supporting *in vitro* fertilization (IVF), this study examined the effect of exposing equine sperm to different concentrations of caffeine, thimerosal and thapsigargin, three reagents demonstrated to induce hyperactivation in other species. Sperm from three ejaculates from each of three stallions were exposed to concentrations gradients of each of these reagents to examine their effect of sperm hyperactivation using a computerized sperm motility analyzer (CASA) to measure motion parameters associated with this pattern of motility. In all experiments, positive controls included treatment with procaine. All three reagents tested failed to induce hyperactivation in the stallion, suggesting physiological differences in the response of stallion sperm to these reagents as compared to other species.

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## Dermatological Analysis of Wings from Bats with White Nose Syndrome

BEN GOLAS

Under the supervision of Dr. Elizabeth Buckles

Department of Biomedical Sciences

White Nose Syndrome (WNS) is an emerging disease that is killing hibernating bat populations in the Northeast U.S. It is characterized by an early loss of subcutaneous fat in hibernation, abnormal hibernatory behaviors, and white fungal growths on the nose, ears, and wing membranes. A collaborative effort is underway to find the cause in order to form a management plan to save the bats. To evaluate the pathogenic role of the WNS fungus, a new species of *Geomyces*, wing membranes were collected from 166 bats in New York, Vermont, and Missouri over a period from September to March. Each was given an independent objective score from 0 (absent) to 4 (severe) for amount of fungus, degree of fungal invasion, amount of bacteria, inflammation, and necrosis, and total score was calculated by summing these. Data showed that amount of fungus, degree of invasion, and consequently total score increased between October and December and remained high through winter to March. Amount of bacteria, inflammation, and necrosis had no obvious patterns over time. Only 14.3% of the time that necrosis and inflammation were present was fungus clearly associated with it. However, of the cases with necrotic and inflammatory lesions, bacteria were clearly associated 38.1% of the time. Furthermore, there was an apparent direct relationship between amount of bacteria and necrosis. This data suggested that the fungus is not the source of WNS, and that bacteria may be of interest as a causative agent.

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## Effect of Early Lactation Ewe Nutrition on Lamb Growth

LAURA B. HARTHAN

Under the supervision of Dr. Debbie Cherney  
Department of Animal Science

In today's market, it is important that livestock farmers feed their animals less expensive, efficient feedstuffs to remain profitable in the face of decreasing meat prices and increasing feed prices. This study looks at the use of okara, a waste product from the production of tofu and soymilk, as a protein supplement for lactating ewes. In a replicated four-by-four Latin square trial, eight ewes and their twin lambs were fed four different diets. The four diets were: Diet A, a wheat middling and corn concentrate fed with a mixed grass hay; Diet B, an okara and corn concentrate fed with mixed grass hay; Diet C, a soybean meal and wheat middling concentrate fed with haylage; and Diet D an okara and corn concentrate fed with haylage. Ewe weights, lamb weights and daily feed intakes were recorded and milk samples were taken to determine the effect of the diets on the growth and feed intake of the animals and milk composition. The diets had no statistically significant impact on ewe or lamb growth, overall dry matter intake or growth efficiency, but there was significant difference in the amount of different diet forage and concentrate consumed. There was also no effect on milk composition, though there were some trends observed. Based on these findings, okara is a viable source of protein for lactating ewes and can be used as a supplement without any adverse effects on growth or milk composition.

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## Development of Methodologies and Initial Testing for a Survey of the Northeastern United States for the Presence of *Angiostrongylus vasorum*

ELLEN K. HAYNES

Under the supervision of Dr. Dwight Bowman  
Department of Microbiology and Immunology

*Angiostrongylus vasorum* is a metastrongyloid parasite that infects the pulmonary arteries and respiratory tract of wild and domestic canids. Foxes serve as a disease reservoir and gastropod intermediate hosts and vertebrate paratenic hosts transmit infection between canids. *A. vasorum* infection is currently considered enzootic in areas of Europe, South America, Africa, and North America, and has become more common in eastern coastal Canada over the past decade. The only reported cases of *A. vasorum* infection in the United States were in a greyhound imported from Ireland and in a dog abandoned in Long Island. Since there is concern that *A. vasorum* may have spread to the United States from Canada, this project aimed to initiate a survey of the northeastern United States for the presence of *A. vasorum*. The heart and lung tissues of 14 foxes from northeastern New Hampshire were examined, but no *A. vasorum* worms were recovered. As a model for *A. vasorum* infection in gastropods, snails were infected with first-stage larvae of *Aelurostrongylus abstrusus* or *Didelphostrongylus* sp., two metastrongyles that also use snails as intermediate hosts. Third-stage *A. abstrusus* larvae were recovered from one successfully infected snail after snail tissue digestion in a pepsin/HCl solution. This project established a working PCR detection methodology, snail infection and digestions protocols, and a library of metastrongyle DNA to be used in testing methods for *A. vasorum* detection.

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## The Effect of Intake Level of a Soy Hull Diet on Digestibility in Ram Lambs and Mature Non-Lactating Ewes

DANIELLE C. HEIN

Under the supervision of Dr. Michael Thonney  
Department of Animal Science

There is a positive effect of soy hull feed supplementation on production and intake in ruminants. This is due to the high fraction of fermentable neutral detergent fiber (FNDF) found in soy hulls, which is highly digestible by rumen microbes and may optimize VFA production for rumen health. However, high levels of intake of a soy hull diet can decrease digestibility due to an increased rate of passage. In this project, the effect of feeding soy hull-based diets at intake levels of 2, 3, or 4% of body weight was quantified in weanling ram lambs and mature, non-lactating ewes. The apparent dry matter digestibility (DMD) and digestibility of NDF were quantified using a chromium marker which was measured in the feed and feces. In ram lambs, apparent DMD decreased by 8.3 percentage units and digestibility of NDF decreased by 12.1 percentage units for each 1 percentage unit increase in DMI as a percentage of BW ( $P < 0.001$ ). In mature ewes, the depression in digestibility was less pronounced, with DMD decreasing by 2.9 percentage units and digestibility of NDF decreasing by 4.5 percentage units for each 1 percentage unit increase in DMI as a percentage of BW ( $P = 0.034$ ). These experiments demonstrated a linear decrease in digestibility with increased intake, and the decrease was less severe in sheep being fed at or near their maintenance requirement.

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## The Effect of Dietary Linoleic Acid on the Incorporation of Omega-3 Fatty Acids from Flaxseed into Egg Yolk

ILYSSA L. MEREN

Under the Supervision of Dr. Richard Austic  
Department of Animal Science

Linoleic acid (an omega-6 fatty acid) and  $\alpha$ -linolenic acid (an omega-3 fatty acid) are essential dietary polyunsaturated fatty acids (PUFA). They are converted into longer chain PUFA through common enzymes in tissues. The amount of longer chain omega-3 and omega-6 PUFA synthesized in the hen may depend on the ratio of linoleic to  $\alpha$ -linolenic acid in the diet. Poultry diets usually contain high levels of linoleic acid from corn. The objective of this experiment was to determine whether a low dietary ratio of linoleic acid to  $\alpha$ -linolenic acid would increase the incorporation of longer chain omega-3 PUFA such as docosahexaenoic acid (DHA) in eggs. Four experimental diets and one control diet were fed to 6 replicates of five chickens for six weeks. Diets 1 and 2 were based on wheat, and diets 3 and 4 were based on triticale, which are both low in linoleic acid. Diets 1 and 3 were supplemented with 2% olive oil, which is low in linoleic acid. Diets 2 and 4 were supplemented with 2% corn oil, which is higher in linoleic acid. Diet 5 was a typical poultry diet based on corn. All diets contained 9% flaxseed as a source of  $\alpha$ -linolenic acid. Feed intake, egg production, and body, yolk, and egg weights were documented. Egg yolk lipids were extracted and analyzed for fatty acids by gas chromatography. The results indicated that DHA incorporation into egg yolks increased by 33% as a result of the lower linoleic acid to  $\alpha$ -linolenic acid ratio.

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## Genetic Engineering of an *Escherichia coli* Mutant Phytase for Thermostability Does Not Affect the Enzymatic Efficacy in a Diet for Young Pigs

LONNIE E. ODOM

Under the Supervision of Dr. Xingen Lei  
Department of Animal Science

Previous protein engineering research in this laboratory has yielded an *Escherichia coli* AppA2 mutant phytase (M2) with improved thermostability and an *Aspergillus niger* PhyA mutant phytase (PhyA27) with improved thermostability and pH profile. The objective of this study was to determine the effectiveness of these phytase variants in improving phytate phosphorus utilization by weanling pigs. A total of 40 pigs (5-week old, Yorkshire-Landrace-Hampshire crossbred) were fed a corn-soybean meal based basal diet (BD, without supplemental inorganic phosphorus) or the BD supplemented with AppA2, M2, or PhyA27 at 300 U/kg of diet for four weeks. The phytase activity was assayed in citrate buffer, pH 5.5. Pigs (n = 10/treatment) were housed individually and had *ad libitum* access to feed and water. Daily feed intake and weekly body weight of individual pigs were recorded, and blood samples of individual pigs were taken weekly to measure plasma inorganic phosphorus concentrations and alkaline phosphatase activity. Pigs fed the wild-type and the AppA2



mutant phytases had higher ( $P < 0.01$ ) plasma inorganic phosphorus concentrations from week 2 through week 4 and lower ( $P < 0.05$ ) plasma alkaline phosphatase activity in week 4 than did pigs fed the BD or the PhyA mutant. The latter two groups showed similar values in these measures. The overall growth performance of pigs was not affected by the dietary treatments. In conclusion, M2, engineered for improved thermostability, was as effective as AppA2 in releasing phytate phosphorus from the diet for weanling pigs.

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## Hedgehog Signaling Plays a Critical Role in Directing Correct Primordial Follicle Formation in the Mouse Ovary

HEATHER B. PHILLIPS

Under the supervision of Dr. Susan Quirk  
Department of Animal Science

The Hedgehog (HH) signaling pathway has been identified to play an essential role in cell differentiation, cell fate determination and cell proliferation in both *Drosophila* and mammalian models. While much is known regarding HH actions in the *Drosophila* ovary, its role in the developing mammalian ovary remains a mystery. In the days following birth, the mouse ovary transitions from an organ filled with ovigerous cords to one filled with primordial follicles, which are oocytes surrounded by a layer of flattened pre-granulosa epithelial cells, enclosed by a basement membrane, and associated with mesenchymal cells. The purpose of this study was to determine the role HH plays in primordial follicle formation in the mouse ovary. HH signaling was blocked by injecting cyclopamine, a plant alkaloid known to inhibit HH signaling, on days 0, 1, 2 and 3 after birth. Immunohistochemistry using an antibody for laminin, a common basement membrane protein, revealed a significantly higher number of discontinuous basement membranes around primordial follicles in ovaries extracted from cyclopamine-treated mice. H&E staining revealed a significantly lower ratio of mesenchymal cells to oocytes in ovaries from cyclopamine-treated mice, as compared to controls. The reduced HH signaling in this study is thought to have disrupted proper ovigerous cord breakdown and interfered with normal cell communication among oocytes, epithelial cells and mesenchymal cells, suggesting that the HH signaling pathway does play a critical role in directing correct primordial follicle development. This study provides valuable insight into the role HH plays in the developing mouse ovary.

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## Development of a Recombinant Protein Based Lateral Flow Assay to Detect *M. avium* Subspecies *paratuberculosis* Infection in Cattle and Sheep

KRISTIN M. PUFFAFF

Under the supervision of Dr. Jerrie Gavalchin  
Department of Animal Science

The focus of this project was development of a lateral flow-based dipstick assay for the detection of *M. avium* subspecies *paratuberculosis* (MAP) antibodies in cattle and sheep. *M. avium* subspecies

*paratuberculosis* is the causal agent of Johne's disease. Johne's disease is a chronic wasting disease caused by scarring due to *MAP* infection in the lower ileum of ruminants. Currently, diagnosis is difficult because there are only low levels of bacterial shedding and antibody production during the non-clinical stages of infection.

The proposed method would overcome several of the obstacles that limit the usefulness of the current assays. The method is low cost, can be performed by anyone who can draw blood, and has a potential for extensive signal amplification that could be used to detect non-clinical antibody production. This thesis describes preliminary work to identify suitable antigens that are reactive with anti-*MAP* antibodies. We first tested the *MAP* antigen contained in the Johnen preparation used for skin testing, but it was not an effective antigen for antibody capture for a number of reasons. These included lack of consistency in the source of antigen and the limited binding of *MAP* antigen to nitrocellulose paper used in the proposed assay.

Three recombinant proteins were identified as potential antibody targets based on the work of Dr. Yung Fu Chang. This paper outlines the growth and purification procedure for two of these proteins, the Superoxide dismutase (SOD) protein and the 85b protein, as well as the preliminary tests done with the 85b protein.

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## The Efficacy and Welfare Implications of Surgically-Placed Crib Rings in Horses

KAITLIN E. QUIRK

Under the supervision of Dr. Katherine Houpt  
Department of Clinical Sciences

Domestic horses' natural grazing behavior is largely limited by stabling. Consequently, some animals develop behaviors such as cribbing, an oral stereotypy linked to bowel obstruction, lower learning ability, dental wear, and general loss in value. The present study tested surgically-placed "crib rings" for efficacy in cribbing control and effects on welfare. Small hog rings (copper covered steel, 1-5/32" or 1-1/2") were placed into each of six adult cribbing horses' gums, between the upper incisors, under sedation with 0.1 to 0.2 mg/kg Detomidine. Horses were recorded 24 hours per day in the stall as well as several times per week in five-minute grazing intervals. Blood was drawn daily to test for plasma cortisol concentration. Horses were observed for several weeks before and after surgery. Average time spent cribbing and eating and average bites per minute while grazing were calculated and compared using the student's paired t-test with alpha-level 0.05. Horses spent significantly less time cribbing ( $P=0.002$ ) and more time eating ( $P=0.002$ ) post-operation. They also took significantly fewer bites per minute grazing with the rings placed ( $P=0.004$ ). Cortisol levels were significantly higher ( $p=0.001$ ) on surgery day but dropped by day one; there was no significant increase post-surgically. Overall crib rings appeared effective; however, four of the six horses returned to cribbing due to loss or bending of the rings. Long term efficacy is thus questionable. Eating may have been a replacement behavior for cribbing or longer eating time and less grazing may indicate discomfort; however, cortisol results did not indicate chronic stress.

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## Macrophage Migration Inhibitory Factor (MIF) and Tumor Necrosis Factor Alpha (TNF- $\alpha$ ) as Diagnostic Markers in Septic Foals

ERICA J. SECOR

Under the supervision of Dr. Julia Flamino  
Department of Clinical Sciences

Macrophage migration inhibitory factor (MIF) is a cytokine released from a variety of cells, including macrophages, lymphocytes, and cells of the anterior pituitary gland upon stimulation by infection with gram-negative and gram-positive bacteria. Tumor necrosis factor alpha (TNF- $\alpha$ ) is a proinflammatory cytokine that plays a key role in the development of the immune response. Sepsis occurs if bacteria or their toxins enter the systemic circulation and sets off a widespread inflammatory response in the body. Sepsis is a common concern in equine neonates, and diagnostics often come too late in the disease process. Both MIF and TNF- $\alpha$  have been shown to increase in cases of sepsis and septic shock in humans. The goal of this research was to determine whether septic foals exhibit a similar profile of MIF and/or TNF- $\alpha$ . It was hypothesized that MIF and TNF- $\alpha$  would increase in response to sepsis in foals. Foals between 4 and 14 days of life admitted to the Cornell University Hospital for Animals were given a sepsis score at presentation, and blood samples were taken at various intervals. Expression of the MIF gene in peripheral blood leukocytes (PBL) was evaluated using reverse transcriptase PCR analysis, and serum MIF and TNF- $\alpha$  concentrations were analyzed using ELISA. Data suggested a decrease in MIF expression in PBL with clinical recovery in some septic foals. Surprisingly, serum MIF concentrations were significantly higher in healthy foals than hospitalized foals ( $p = 0.049$ ) or adult horses ( $p = 0.01$ ). Preliminary data suggests that TNF- $\alpha$  is absorbed by neonates via colostrum. MIF and TNF- $\alpha$  were not reliable markers to detect sepsis in foals at a single time point. It is possible that pro-inflammatory proteins are present in the neonate or transferred by colostrum with the purpose of improving the innate immunity during this critical phase of life. Therefore, *temporal* analysis of pro-inflammatory markers may better indicate disease progression, treatment response and prognosis for life.

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## Survey of Retail Milk: Comparison of the Fatty Acid Composition of Conventional Milk and Milk Labeled as “rbST-Free” and “Organic”

KAYLAN P. SPATNY

Under the Supervision of Dr. Dale Bauman  
Department of Animal Science

In recent years, milk selection in retail stores has expanded. Conventional, rbST-free and organic labeled milk are characterized by different management practices. The fatty acid composition of milk can be modified by manipulating the cow's diet; however it is unclear whether the milk labeling differences in cow management affect the composition of milk fat. The objective of the present study was to compare the fatty acid composition of conventional milk with that labeled as

rbST-free or organic. A total of 296 samples were collected in blocks containing conventional, rbST-free and organic milk from retail stores in the 48 contiguous states. Fatty acids were extracted, methylated, and gas chromatography was used to quantify individual fatty acids. Conventional and milk labeled as rbST-free showed no differences in fatty acid composition. Organically labeled milk was similar, with minor statistical differences from conventional and rbST-free milk. These differences included greater levels of *trans*-11 18:1 (vaccenic acid; VA), *cis*-9, *trans*-11 C18:2 (rumenic acid; RA), as well as greater total saturated fatty acids, lower monounsaturated fatty acids and lower total *trans* fatty acids. The variation in RA and VA in organic milk was greater as compared to the variation observed for conventional and rbST-free milk samples. Overall, some differences were significant in organic milk fatty acid composition, but these were minor and quantitatively of no biological importance in comparing conventional, rbST-free and organic milk.

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## Evaluation of a Vaccine Against *Mannheimia haemolytica* and *Pasteurella multocida* in Sheep

TAO SUN

Under the supervision of Dr. Jerrie Gavalchin  
Department of Animal Science

Of the 20 currently identified species in the genus *Pasteurella*, *Mannheimia haemolytica* and *Pasteurella multocida* are the most important respiratory pathogens affecting domestic ruminants, especially in sheep and cattle, together causing pneumonia. This disease is a leading cause of economic loss in the sheep industry. Factors such as transportation, viral infection, and overcrowded housing, may predispose the opportunistic infection by the pathogen. At present, several commercial vaccines have been developed to control pasteurellosis in sheep, including types such as bacterins, live attenuated, leukotoxin, capsule, lipopolysaccharide, subunit vaccines, sodium salicylate extract and potassium thiocyanate. Previous studies have shown that effective specific antibody response against *M. haemolytica* whole-cell antigen could be achieved via vaccination. However, for *P. multocida*, vaccines did not induce strong specific antibody response and some reports even suggested an increase in severity of infection by *P. multocida* after vaccination.

In this study, the efficacy of an autogenous vaccine made from antigens from both *M. haemolytica* and *P. multocida*, was evaluated by measuring specific serum antibody titers produced against both bacteria in immunized sheep. Sera were obtained from all control (unvaccinated) and vaccinated lambs 1 week prior to vaccination and weekly for 3 weeks after vaccination. The results showed that the vaccine induced significant antibody response against *M. haemolytica* in both ewes and rams after 7 days post vaccination. For the response to *P. multocida*, specific antibodies were induced in ewes; however, the vaccine failed to stimulate specific antibody production against *P. multocida* in rams.

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## Sensitivity of the S14 Null Mouse to *trans*-10, *cis*-12 Conjugated Linoleic Acid in the Regulation of Milk Fat Depression

MIYUKI TANINO

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Department of Animal Science

*Trans*-10, *cis*-12 conjugated linoleic acid (CLA) is a fatty acid intermediate produced during rumen biohydrogenation of dietary polyunsaturated fatty acids in the cow. CLA inhibits *de novo* milk fat synthesis in the mammary gland through a coordinated downregulation of key lipogenic enzymes and the protein thyroid hormone responsive spot 14 (S14). A previous study using a mouse model showed that the S14 knockout mouse was hyperresponsive to CLA. Mammary lipogenesis decreased by 82% in knockout mice and by 23% in wildtype mice in response to a 5-day treatment of 20 mg/d CLA. The objective of the present study was to investigate whether the knockout mouse was also hypersensitive to CLA by testing the lactogenic response of the mice to a low dose of CLA. Wildtype and knockout C57BL/6J mice were orally administered with either water (control) or 3.5 mg/d of CLA for 5 days. CLA treatment caused a 28.7% reduction in the percentage of *de novo* synthesized fatty acids in milk in knockout dams, whereas in wildtype dams this reduction (8.9%) was not significant, and there was an interaction of genotype and CLA treatment. Investigations with mammary explants demonstrated that lipogenic capacity decreased in both knockout and wildtype dams, but there was no interaction of genotype and CLA treatment. A compilation of results from the present and previous studies suggests that the ED<sub>50</sub> of CLA of the wildtype and knockout mice, and thus their sensitivity, are similar. Therefore, the S14 knockout mouse is hyperresponsive to CLA-induced inhibition of mammary lipogenesis but sensitivity is unaltered.

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## Population Genetics of the Recent Transcontinental Colonization of South America by Breeding Barn Swallows

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Well characterized intercontinental colonizations by birds are rare. In 1980, six pairs of Barn Swallows were found breeding in Argentina within the species' historic wintering range, and this South American population has since grown to thousands of pairs. We explored the genetic context and consequences of this colonization event via comparisons among the South American population and two North American populations. We tested for evidence of a genetic founder event by assessing allelic diversity at eight microsatellite loci and haplotype diversity of mitochondrial ND2 sequences. Contrary to our expectations, the recently established South American breeding population of Barn Swallow showed no evidence of a founder effect, with no difference in heterozygosity, allelic diversity, haplotype diversity, or population differentiation relative to the North American populations. The genetic similarity of these populations suggests that this long-distance colonization event was not associated with a strong demographic bottleneck, possibly because the South American population has continued to receive gene flow via ongoing immigration from North America.

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## Determining Viability and Identifying Functional Domains of STU1 Through Carboxyl-terminus Truncations

LILY CAO

Under the supervision of Dr. Tim Huffaker  
Department of Molecular Biology and Genetics

The mitotic spindle is essential for the proper division of genomic information during mitosis. In humans, improper segregation of chromosomes can lead to disorders such as cancer and Down syndrome. Many proteins associate with the microtubules that make up the mitotic spindle. For example, Stul is an essential microtubule binding protein in *S. cerevisiae* responsible for the assembly and dynamic function of mitotic spindles. It has been shown to localize at the plus-ends of microtubules as well as the kinetochores on chromosomes. One function of Stul is to attach the plus-ends of microtubules to the chromosomes, allowing the chromosomes to be mobilized. Mutations in the protein lead to spindle collapse, mis-segregation of chromosomes, and therefore, degradation of cell growth. In order to perform a functional analysis to identify domains that allow Stul to bind to kinetochores, microtubules, and other proteins important for Stul to carry out its job, various lengths of the carboxyl-terminus coding region of the gene were deleted. Cell viability, protein levels, and protein localization were analyzed. The results indicate that no more than 100 amino acids can be deleted for viability to be maintained, suggesting that the carboxyl-terminus of Stul is essential for the proper functioning of the protein. Furthermore, these proteins seem to localize preferentially to

short spindles of pre-anaphase cells. Overexpressing the truncated proteins allows more of the carboxyl-terminus to be deleted, yet still sustain cell viability. In these cells where *stu1<sup>ΔC</sup>* is overexpressed, the protein still binds preferentially to short spindles, leading to the hypothesis that the localization of the shortened protein to microtubules decrease as cells move from metaphase to anaphase.

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## Ontogeny of the Mother-calf Relationship in African Forest Elephants, *Loxodonta africana cyclotis*

GITA CHELLURI

Under the supervision of Dr. Peter Wrege  
Lab of Ornithology

African elephants, *Loxodonta africana*, comprise two subspecies which inhabit different environments, which allows us to investigate how differences in ecology influence the expression of social behaviors. Parenting, performed solely by the mother in elephants, is a long-term and psychologically important behavior which may vary between forest elephants, *L. africana cyclotis*, and savanna elephants, *L. africana africana*. Three ecological factors are of particular interest in the rarer and lesser-known forest subspecies: smaller family group size than in savanna elephants; the dispersal of adult females along with adolescent males; and the presence of highly contested mineral pits in forest clearings (bais). Despite the fact that forest elephant calves have few family members present, they do not engage in friendly mother-calf interactions at higher rates than do their savanna counterparts. The fact that both male and female forest elephants disperse may account for a decrease in friendly mother-calf interactions with age, consistent with explanations for an analogous decrease among savanna elephant males (Lee 1986). The rate of maternal aggression increased as forest elephant females aged, likely due to increased competitiveness with the mother for mineral pits, while the rate decreased for more independent males. In examining the dispersal syndrome, it appears that longer separations from the mother do not represent a preparatory behavior, since age of the calf did not significantly affect the duration for either male or female calves. The presence of an older sibling, who may act as an allomother, did, however. This research underscores the importance of mineral pits as an influence on the family dynamics in bais, given that aggression revolved around pits, calves often wandered in order to access pits, and mothers did not frequently initiate reunion with separated calves due to occupation of a pit.

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## Barley Stripe Mosaic Virus Induced Gene Silencing in Wheat Seeds

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Department of Plant Breeding and Genetics

Virus Induced Gene Silencing (VIGS) using Barley Stripe Mosaic Virus (BSMV) is an important reverse genetics tool in wheat, but all published protocols are limited to wheat

leaves. The goal of this study was to demonstrate that Barley Stripe Mosaic Virus (BSMV) can be used for Virus Induced Gene Silencing (VIGS) in wheat (*Triticum aestivum* L.) seeds and to utilize this method to examine genetic control of pigmentation in wheat seeds. To facilitate rapid BSMV construct generation the Gateway® recombination cloning system was used and was demonstrated to be equivalent to constructs without Gateway® sites. The model wheat variety, Chinese Spring, was infected with BSMV and the phenotype evaluated for the effects of the virus and the target gene RNAi knockdown. Using a GFP expression construct it was demonstrated that BSMV can infect wheat seeds and replicate indicating that BSMV can be used for VIGS in wheat seeds. Preliminary results using BSMV RNAi constructs for chalcone synthase and dihydroflavanol-reductase resulted in reduced expression and somewhat reduced pigmentation. These studies indicate BSMV can be used for VIGS of target gene expression in Chinese Spring wheat seeds.

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## Defense Against Humans, Habituation to Human Presence and Neophobia in Nesting Tree Swallows (*Tachycineta bicolor*)

KRISTIN GILL

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Wild birds raising young take personal risks and endanger themselves to defend their brood. The threats they face include both attempts at predation and random changes in the environment of the nest. I observed the defense behaviors of tree swallows (*Tachycineta bicolor*) against a human approaching the nest box during two breeding seasons. In addition, during the second season I also observed the neophobic reactions of the parents to alterations at the nest box and their habituation to both forms of potential threat. The use of two different sites allowed comparison of the behaviors of birds in areas of high and low human activity. Nests were grouped and then tested on certain days during the growth period of the chicks, allowing comparison of the behaviors of parents with younger and older offspring, as well as testing to see if the birds habituated to the trials.

I found that there were few significant differences between the sexes in terms of behavior, except that males tended to call more in defense of a nest and habituated much more rapidly to repeated simulated predation trials. Success in one season seems to be important in determining the behavior of a bird during the next breeding season, with birds that did poorly compensating by increasing their aggression during that following year. Neither age of parent nor chicks had any detectable effect on the behavior of the parent. However, while all of these factors are important, individual birds also showed behavioral consistency during and across seasons. The neophobia trials were successful in that the birds had longer latencies to return to and enter the box when the experimental stimulus was present than during the control trials, but they did not seem to habituate to this form of experimentation.



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## Expression and Localization of Connexin 43 in Cartilage of Horses with Osteochondrosis dissecans

YANG GU

Under the supervision of Dr. Alan Nixon  
Department of Clinical Sciences

Osteochondrosis dissecans (OCD) in growing individuals represents a chondrodysplasia with uncertain etiology. Regions of retained cartilage result from retardation of the progression of subchondral ossification (Glaser et al). Focal avascular necrosis is hypothesized to initiate OCD. The molecular events defining OCD, a prevalent developmental joint disease in human and animal, have been limited to the study of a relatively small number of candidate molecules. After examining a large-scale microarray study, two of the most dysregulated genes were Connexin 43 (Cx43), a gap junction protein encoded by the GJAP1 gene, which provides routes for the movement of low-molecular weight materials, and Proteoglycan 4 (PRG4), a surface lubricating protein.

Using more advanced quantitative real-time polymerase chain reaction (RT-PCR) method, Cx43 was found to be expressed 7-fold higher in OCD cartilage than normal cartilage, and PRG4 was found to be expressed 3-times lower in OCD cartilage than normal cartilage. Through histological methods of immunohistochemistry and *in-situ* hybridization, Cx43's expression and translation were found to be around the area of osteoclasts/ chondroclasts as well as the subchondral bone separation as a result of the OCD lesion with clefting.

We hypothesize Cx43 has the ability to attenuate the inflammatory processes and further damage the surrounding tissues. At the same time, PRG4 is down-regulated due to the surrounding inflammatory environment.

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## Purification and Molecular Structure of Digalactosyl *myo*-inositol (DGMI), Trigalactosyl *myo*-inositol (TGMI), and Fagopyritol B3 and Identification of *N*-( $\beta$ -glucopyranosyl)-nicotinic Acid from Buckwheat Seeds by NMR

WEI GUI

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Department of Crop and Soil Sciences

Three galactosyl cyclitols, digalactosyl *myo*-inositol (assigned the trivial name DGMI), trigalactosyl *myo*-inositol (assigned the trivial name TGMI), and trigalactosyl *D-chiro*-inositol (fagopyritol B3), were isolated from common buckwheat (*Fagopyrum esculentum* Moench) seeds. Structures of these three compounds were determined by NMR spectroscopy for the first time. DGMI is  $\alpha$ -D-galactopyranosyl-(1 $\rightarrow$ 6)- $\alpha$ -D-galactopyranosyl-(1 $\rightarrow$ 1)-1L-*myo*-inositol, TGMI is  $\alpha$ -D-galactopyranosyl-(1 $\rightarrow$ 6)- $\alpha$ -D-galactopyranosyl-(1 $\rightarrow$ 6)- $\alpha$ -D-galactopyranosyl-(1 $\rightarrow$ 1)-1L-*myo*-inositol, and fagopyritol B3 is  $\alpha$ -D-galactopyranosyl-(1 $\rightarrow$ 6)- $\alpha$ -D-galactopyranosyl-(1 $\rightarrow$ 6)- $\alpha$ -D-

galactopyranosyl-(1→2)-ID-*chiro*-inositol. Samples of TGMI and fagopyritol B3 also contained the compound *N*-(β-glucopyranosyl)-nicotinic acid as determined by NMR spectroscopy.

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## Polarity Discrimination and Quantitative Analysis of Agonistic Rasp Signaling in the Weakly Electric Fish, *Brienomyrus brachyistius* (Mormyridae)

BRIAN R. ISETT

Under the supervision of Dr. Carl Hopkins  
Department of Neurobiology and Behavior

Mormyrid electric fish extract species, gender, dominance, and orientation information from the waveform of their electric organ discharges (EODs). Orientation information was examined in this study by alternating the polarity of 4 different EODs delivered by a dipole playback electrode (PBE). Fish were found to show a strong head-butt and circle response to the head (+) lead of the electrode, confirming previous studies.

A second experiment was performed with the same playback apparatus to quantify the temporal characteristics of electrical responses to agonistic signals called ‘rasps’. Rasps consist of two bursting patterns: a fast burst (FBr) with inter-spike intervals (ISIs) of 8-20ms, followed by a medium burst (MBr) with ISIs of 30-70ms and are performed when males fight for dominance status, as well as during courtship. Experimental stimulus rasp patterns were gathered from dominant and subordinate males in 3 different contexts, and a looped pattern of natural nocturnal swimming discharges was used as a control.

Testing 14 fish, it was found that rasps quickened in response to the experimental stimuli along three different temporal parameters: rasps/second, rasp duration (seconds) and the shortest ISI achieved (ms). Many dominant individuals were observed ‘rasp matching’ the experimental stimuli, while several subordinates went silent during playback. The dominance status of experimental fish was also measured and revealed that dominant males performed rasps at a higher rate and with shorter ISIs than subordinate males. Subordinate males were often observed delivering more medium bursts and continuous discharges than dominant males.

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## Crystal Structure of Thiamin Phosphate Synthase from *Mycobacterium tuberculosis* at 2.35Å Resolution

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Thiamin phosphate synthase (TPS) is a bacterial protein involved in the biosynthesis of thiamin pyrophosphate (TPP), the active form of thiamin (vitamin B<sub>1</sub>) which is an essential component of the human diet. TPS catalyzes the coupling reaction of pyrimidine pyrophosphate and thiazole

phosphate to form thiamin phosphate (TP). *Mt*TPS is a 23 kDa protein and forms a dimer. The crystal structure of thiamin phosphate synthase from *Mycobacterium tuberculosis* (*Mt*TPS) was determined at 2.35 Å resolution. Thiamin phosphate synthase has an  $\alpha/\beta$  structure with a triosephosphate isomerase (TIM barrel) fold. The *Mt*TPS structure clearly shows that it is very similar to the structure of *Bacillus subtilis* TPS. The active site of *Mt*TPS is highly conserved when compared to *Bs*TPS and a phosphate group is bound in approximately the same position as in *Bs*TPS.

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## The Function of *DINE-1* in *msl2*

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Dosage compensation in *Drosophila* is a process through which gene expression on the single male X chromosome is amplified to the expression level of females (Bashaw and Baker 1997). The gene *male-specific lethal 2* (*msl2*) is absolutely critical to this process, since it contains the DNA binding domain of the macromolecular MSL complex, which is responsible for gene upregulation. In addition, *msl2* is also translationally silenced in females, in order to prevent assembly of the MSL complex. *DINE-1*, an abundant transposable element, is present in the 3'UTR of *msl2* of *D. melanogaster*. Since the 3'UTR is critical to the regulation of *msl2* expression, we sought to explore the impact of *DINE-1* excision on MSL expression and the viability of males expressing the transgene. Furthermore, since expression levels are known to be influenced by temperature, we studied the impact of *DINE-1* excision across three different temperatures. Our results demonstrate that *DINE-1* element has a neutral impact on the function of *msl2* in females, but may increase expression in males at low temperatures.

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## Development of a Purification Procedure for the Diguanylate Cyclase PA4843 from *Pseudomonas aeruginosa* for Structural and Functional Studies

YEE LING LAM

Under the supervision of Dr. Holger Sondermann  
Department of Molecular Medicine

In recent years, vast research efforts have concentrated on understanding and tackling antibiotic resistance and tolerance in biofilm-based infections. Bacteria that participate in biofilms are protected against detergents and drugs by a polymeric matrix they secrete and reside in. The conversion of free floating bacteria to a community of bacterial cells in a matrix requires a significant change in gene expression profile that is tightly regulated. Central to the signaling leading to biofilm formation is a second messenger, bis-(3'-5')-cyclic dimeric guanosine monophosphate (c-di-GMP). C-di-GMP signaling is only found among prokaryotes and therefore may present an ideal therapeutic target. C-di-GMP is synthesized by diguanylate cyclases with a characteristic GGDEF motif. By structural and

functional characterization of these enzymes, we hope to provide insight in the molecular mechanisms controlling biofilm formation and virulence. PA4843 is a typical diguanylate cyclase from *Pseudomonas aeruginosa*, consisting of a catalytic domain and a regulatory domain. In order to obtain a three dimensional structure of PA4843, the enzyme has to be purified to homogeneity and in large quantities for crystal screens. Yet, the purification was challenged by the instability of enzyme *in vitro*. Buffer optimization and limited proteolysis were employed to improve enzyme solubility. These experiments have revealed that PA4843 has a flexible N-terminus comprising the first 100 residues and a stable C-terminal domain. Various truncations were made for the enzymes to determine the construct boundaries that warrant maximal stability, expression and activity. A protein spanning residues 110-542 was found to possess promising stability and expression that can potentially crystallize.

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## Isolation and Sequence Analysis of ARSs and Flanking Elements from *Saccharomyces kluyveri*

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Under the supervision of Dr. Bik-Kwoon Tye  
Department of Molecular Biology and Genetics

DNA replication is a highly conserved process essential for the perpetuation of all life forms. Initiation of DNA replication occurs at specific sites called replication origins. The essential DNA elements that constitute these sites are not fully understood in eukaryotes. Studying origins of replication using budding yeasts as a model may provide useful information for deciphering essential components of replication origins in higher eukaryotes, including humans. Origins of replication (also known as autonomously replicating sequences or ARSs) are well characterized in the budding yeast species *Saccharomyces cerevisiae*. *S. cerevisiae* ARSs contain an ARS consensus sequence (ACS) that is essential but not sufficient for supporting replication initiation. Little is known about the essential elements of replication origins in other yeast species or in higher eukaryotes. In this study, I have cloned and analyzed the sequence of several ARSs from *Saccharomyces kluyveri*, and an ARS consensus sequence has been identified, similar to that of *S. cerevisiae* in that both ACSs are AT-rich 17 bp sequences. Additionally, I have discovered flanking elements that are essential for the function of certain *S. kluyveri* ARSs. This study provides preliminary data on the essential ACS and a flanking element that constitute functional replication origins in *S. kluyveri*.

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## Retronasal and Oral-Cavity-Only Responses to TRPM8 Odorants

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Retronasal (retro) and/or oral-cavity-only (OCO) smelling of vapor-phase agonists for the trigeminal chemoreceptive ion channel TRPM8 was studied. In a retro and OCO identification experiment, 1 of 6 previously practiced identifications (ID) was selected on a computer display under forced-choice

conditions. Analyses of variance (ANOVA) found differences across odorants and retro and OCO, and for retro and OCO separately. Within retro smelling, median correct ID and modal ID (in parentheses) for eucalyptol was 100% (ointment), different from all other odorants. Geraniol 67% (lemon) and linalool 67% (cleaner) differed from dl-menthol, but isopulegol, dl-menthol and l-carvone did not differ. With OCO smelling, ID for geraniol fell to 0% and linalool to 33%, but no significant change for eucalyptol ID at 84%. A second, OCO-only triangle test examined discrimination of geraniol, l-carvone, and isopulegol from sunflower oil. ANOVA found overall differences and Wilcoxon tests found significant pairwise differences between all three odorants. Isopulegol was discriminated by 100% of participants; l-carvone, by 53%; geraniol, by 13%, implying insignificant OCO geraniol discrimination, but significant discrimination of both isopulegol and L-carvone in comparison with the non-odorant, sunflower oil. The differential OCO ID and discriminations indicate that TRPM8 channels are not the only oral cavity trigeminal mechanism for these odorants, while the retro versus OCO differences suggest either olfactory involvement or distinct oral and nasal cavity trigeminal arrays.

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## The Role of miRNAs in Mammary Cancer Stem Cells

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Cancer stem cells (CSCs) are a subpopulation of tumor cells that are derived from transformed stem cells, progenitor cells, or more differentiated proliferating cells. These cells possess both the ability to self-renew to repopulate tumors and to differentiate to form heterogeneous populations of cells. Cancer stem cells were isolated from a mouse model of breast cancer associated with *p53* and *Rb* deficiency in mammary epithelial cells using the CD49f and CD24 cell surface markers. The role of miRNAs as important regulators of gene expression led us to ask whether miRNAs may be involved in the regulation of CSCs. Microarray analysis identified several miRNAs that are differentially expressed in CSCs as compared to other neoplastic cells. The two most downregulated miRNAs, *miR-376b* and *miR-467b*, were selected for further studies. These two miRNA were found to be downregulated in both CSCs and MaSCs (Mammary Stem Cells) as compared to CnSCs (Cancer non Stem Cells) and differentiated mammary epithelial cells. Reconstitution of miRNA expression in mammary carcinoma cells resulted in an overall decrease in proliferation and an increase in apoptosis. Using bioinformatics, we identified proto-oncogenes *Cellular Inhibitors of Apoptosis (cIAPs)* as targets of both miRNAs. The effects of miRNA reconstitution were further validated by determining changes in cIAP expression by quantitative RT-PCR, western blotting, and a luciferase reporter assay. Given the preferential expression of *cIAPs* in CSCs, these results indicate that *miR-376b* and *miR-467b* may regulate CSC survival and proliferation by targeting *cIAPs*. Further studies in this direction may provide the basis for the development of new therapeutic uses of miRNAs as regulators of oncogenes in CSCs.

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## Gender, Age, and Stress Plasticity in BK Channel Expression in the Mouse Adrenal Medulla

CINA SASANNEJAD

Under the supervision of Dr. David McCobb  
Department of Neurobiology and Behavior

Catecholamine release from chromaffin cells in the adrenal medulla is a vital element of the stress response. The activity of large conductance  $\text{Ca}^{2+}$ -and-voltage-gated potassium channels (BK channels) is an important regulator of chromaffin cell excitability. The subunits,  $\beta_2$ ,  $\beta_4$ , and the stress-regulated Slo- $\alpha$  splice variant, STREX, modulate the kinetic properties of BK channels and their sensitivity to chemicals. Previous research has found gender dimorphisms in the expression of Slo- $\alpha$ ,  $\beta_2$ , and STREX mRNA in adrenal medullae from adult SJL mice, with males showing significantly higher expression than females. Recent literature has also identified chronic-stress-dependent increases in the expression of Slo and STREX mRNA in the adult male SJL adrenal medulla. The SJL mouse strain is of interest, as adult SJL males differ from females in size, behavior, and adrenal morphology. This investigation used quantitative real-time RT-PCR to examine changes in the expression of Slo, STREX,  $\beta_2$ ,  $\beta_3$ , and  $\beta_4$  mRNA in the SJL mouse adrenal medulla with respect to gender, stress, and age. Among adult mice tested for Slo, STREX, and  $\beta_2$ , males showed significantly higher mRNA expression in all subunits compared to females. Male adolescent mice showed higher mRNA expression of Slo, STREX,  $\beta_2$ ,  $\beta_3$ , and  $\beta_4$  compared to females, significantly for  $\beta_2$ . Stress increased the expression of all BK subunits in adolescent mice, significantly for  $\beta_2$ ,  $\beta_3$  and STREX. In age comparisons, adolescent mice showed significantly higher expression of  $\beta_2$  mRNA and significantly lower expression of Slo and STREX mRNA compared to adults. These results suggest male mice have more excitable chromaffin cells than do females and provide evidence for a role of chronic stress in shaping excitability and, in turn, levels of catecholamines in the blood.

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## A New Narnavirus that Infects the Late Blight Pathogen, *Phytophthora infestans*, with a Supergroup 2 RNA-dependent RNA Polymerase

THALYANA M. SMITH-VIKOS

Under the supervision of Dr. William Fry  
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*Phytophthora infestans* (Mont.) de Bary is the oomycete that caused the historic Irish potato famine of 1845-1850 and beyond, and it continues to cause worldwide devastation of the modern potato and tomato industries. Double-stranded RNAs (dsRNAs) have been discovered in *P. infestans* but have never been further investigated. Our lab has discovered several dsRNAs that are effectively viral genomes. One of these viruses has been characterized and is tentatively named *Phytophthora infestans* RNA virus 4 (PiRV-4). PiRV-4 has a 3.00 kb genome with one open reading frame (ORF)

coding for a supergroup 2 RNA-dependent RNA polymerase (RdRp). Based on sequence and phylogenetic comparisons, PiRV-4 is most similar to a linear 20S RNA (2.5 kb) narnavirus found in *Saccharomyces cerevisiae*. No virus sequence was found in the *P. infestans* genome. PiRV-4 could not be cured from the *P. infestans* host after three generations of growth on antiviral media; it is still not clear if the virus is affecting the pathogenicity of its host. PiRV-4 is designated as a new member of the genus *Narnavirus* in the family Narnaviridae.

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## The Effects of Protein Kinase Inhibitors, H89 and Chelerythrine, on *Aedes aegypti* Malpighian Tubule Fluid Secretion Rates

TIFFANY SOU

Under the supervision of Dr. Klaus Beyenbach  
Department of Biomedical Sciences

The purpose of this study was to examine the role of protein kinases in mediating the effect of diuretic peptide, aedeskinin-III, on transepithelial fluid secretion. Malpighian tubules were isolated from the female yellow fever mosquito, *Aedes aegypti*, and prepared for study with the Ramsay assay. In 10 Malpighian tubules, control secretion rate was  $0.19 \pm 0.04$  nL/min. After 30 minutes, addition of  $1 \mu\text{M}$  aedeskinin-III to the peritubular Ringer solution increased fluid secretion rates significantly to  $0.63 \pm 0.13$  nL/min. Thereafter, the addition of  $20 \mu\text{M}$  H89, a PKA inhibitor, decreased fluid secretion rate to  $0.24 \pm 0.07$  nL/min. In another 5 Malpighian tubules, control secretion rate was  $0.31 \pm 0.09$  nL/min. After addition of  $1 \mu\text{M}$  aedeskinin-III, fluid secretion rate increased significantly to  $0.90 \pm 0.17$  nL/min. Subsequently,  $20 \mu\text{M}$  chelerythrine, a PKC inhibitor, was added to the peritubular Ringer. In view of the complete inhibition of fluid secretion after 10 minutes of chelerythrine exposure, the effect of chelerythrine on non-stimulated tubules was tested. In 10 tubules, the control rate was  $0.54 \pm 0.07$  nL/min and after 10 minutes, the tubules stopped secreting. These results suggest that protein kinase A is involved in mediating the stimulation of fluid secretion by aedeskinin-III. The results in the chelerythrine studies suggest apparently toxic effects brought about by the relatively high concentration of chelerythrine.

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## The Early Innate Intestinal Immune Response to *Listeria monocytogenes* in BALB/c Mice

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*Listeria monocytogenes* is a facultative intracellular bacterial pathogen capable of escape from vacuoles and intercellular spread. Escape from vacuoles is in part mediated by a broad-range phospholipase C (PC-PLC) whose activity is regulated by pH. Deletion of the sequence coding for the PC-PLC propeptide (*plcB* $\Delta$ pro) generates an enzyme that is constitutively active. Results from oral mouse infections indicated that *L. monocytogenes plcB* $\Delta$ pro is cleared more rapidly from the

intestinal tissues than wild-type bacteria. We hypothesized that the loss of regulation of PC-PLC leads to an enhanced immune response to infection. To test this hypothesis, we infected mice by gavage with either wild-type or mutant bacteria, and we used uninfected mice as controls. The mice were sacrificed between 4 and 40 hours post-infection, and the intestines were collected and processed for evaluation of neutrophil infiltration by immunohistochemistry or for identification of immune cells populating the intestinal tissues by flow cytometry. We observed that the loss of regulation of PC-PLC activity does not change the kinetics, but slightly reduces the overall extent of neutrophil recruitment. However, by 40 hours post-infection there was an increase in the proportion of CD4<sup>+</sup> CD8<sup>+</sup> T cells in the epithelium; increases in the proportions of macrophages, dendritic cells, and T and B lymphocytes in the lamina propria; and increases in macrophages, natural killer cells and natural killer T cells in the lymph follicles. We concluded that the loss of regulation of PC-PLC results in an enhanced immune response to infection by *L. monocytogenes*.

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## Dual Oxidase 2 Mediates Cardiovascular, Autonomic, and Baroreflex Function: An *in vivo* Study in Conscious Mice

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Under the supervision of Dr. Robin L. Davisson  
Department of Biomedical Sciences

Changes in circadian rhythm profiles including phase changes and classical dipper/non-dipper profiles have recently been shown to be affected by reactive oxygen species (ROS) in several hypertensive models. Dual oxidase 2 (DUOX2), a new member of the ROS-producing NADPH oxidase family of enzymes, is primarily responsible for the production of thyroid hormone through its generation of hydrogen peroxide. In addition to hypothyroidism, here we report that global knockout of the DUOX2 gene in mice causes both hypotension and bradycardia basally, which are independent of locomotor activity and that which cannot be rescued by thyroid hormone supplementation. Furthermore, DUOX2 knockout mice exhibit a classical “dipper” profile, which is, at least in part, the result of increased sympathetic control of basal heart rate. Moreover, we report that DUOX2 null mice exhibit an increased baroreflex sensitivity, which was tested by both spontaneous baroreflex analysis and classical vasoactive drug administration. Supplemental real-time PCR and *in situ* hybridization studies confirm the genotype of DUOX2 null mice and demonstrate that DUOX2 is not expressed in the thyroid of null mice, providing rationale for the low plasma T4 levels observed in DUOX2<sup>-/-</sup> mice at baseline. In conclusion, we have determined that DUOX2-mediated pathways participate in the regulation of both blood pressure and heart rate and that this occurs via mechanisms independent of thyroid hormone synthesis.

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## Mechanical Loading, Sex, Age, and Cortical Location Influence Bone Tissue Composition in Mice

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Department of Mechanical and Aerospace Engineering

The application of non-invasive mechanical loads to rodent limbs induces geometric and material changes in the skeleton<sup>11</sup>. Geometric adaptation has been characterized extensively, but the material changes are less well understood. Raman microspectroscopy measures chemical composition at the tissue level and was used to determine the effects of *in vivo* mechanical loading, sex, age, and cortical location on periosteal composition in mouse tibiae. The degree of mineralization (mineral-to-matrix) and carbonate substitution ( $\text{CO}_3^{2-}:\text{PO}_4^{3-}$ ) ratios were used to assess tissue composition. The degree of mineralization at the periosteum was lower with loading in all mouse groups. Sex and age-based differences in mineralization were present in the control limbs. Males had greater mineralization but lower carbonate substitution than females. Mature females were more mineralized than but had similar carbonate substitution to younger growing females. Variation in tissue composition by cortical location occurred in mature females but not in growing females and males. To understand the implications of these findings on functional performance, the material changes reported here need to be combined with geometric and morphological analyses to form a more complete view of structural adaptation of the tibia.

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## Crystallographic Studies on Mutants of *Trichomonas vaginalis* Purine Nucleoside Phosphorylase

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Under the supervision of Dr. Steven Ealick  
Department of Chemistry and Chemical Biology

*Trichomonas vaginalis* is a protozoan human parasite that causes trichomoniasis, one of the most common sexually transmitted diseases in the world. The toxicity of current therapies as well as drug resistance exhibited by certain *T. vaginalis* strains underscores the need for new treatment options. One possibility involves the purine salvage pathway, which is well known for its importance in organisms. Key enzymes in the protozoan pathway, one of which is purine nucleoside phosphorylase (PNP), exhibit important differences from the human homologs, indicating that inhibitors could be identified that affect TvPNP but not the human pathway, as a new class of chemotherapeutic agents against the *T. vaginalis* parasite. The native structure of TvPNP was determined in previous research in order to determine the basis for substrate binding and selectivity. However, the hypothesized interaction between the ligands and the key residue, Asp-204, at the active site of TvPNP was not observed. Thus, our goal is to further understand the active site of TvPNP, particularly with respect to Asp-204 in terms of substrate specificity. To do this, the crystallization of the D204N TvPNP mutants with adenosine and inosine were undertaken, and the interactions between the ligands and the enzyme were analyzed in light of kinetic data.

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## The Effect of Nutrition Labeling on Consumption in Dining Halls

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Nutrition labels were introduced in spring 2008 by Cornell dining to various prepackaged meals on campus. Food sales data were analyzed before and after the nutrition labels went into effect. While a number of previous studies have shown that consumers use nutrition labels when purchasing foods, most of these studies have relied on self-reported data. Previous studies have also shown that consumers may not be able to apply the information on nutrition labels when trying to purchase healthier foods. Therefore, this study sought to determine whether the nutrition labels helped the Cornell community to purchase healthier foods. Foods sold in three dining locations throughout campus were categorized by their amount of calories, fat, sodium, percent calories from fat, and fiber. Food sales data were analyzed using SPSS statistical software (version 16.0) to test for how sales data changed from spring 2007 to spring 2008. The results indicated that there were significant effects of the nutrition labels on which foods were purchased between the two years. Specifically, there was a decrease in the percentage of foods sold with high calories, fat, percent calories from fat, and sodium. However, there was also a decrease in the percentage of sales due to high fiber foods. This study has public policy implications, as menu-labeling laws are becoming more popular across the nation.

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## The Impact of Evolving Computer and Internet Technology on the Legal and Social Constructions of ‘Medical Privacy’ in Contemporary America

ERIC W. SHANNON

Under the supervision of Dr. Katherine McComas  
Department of Communication

The advent of computer and Internet technology have radically challenged American society’s concept of medical information privacy. Through the lens of a novel framework – The “Three D” model – statistical and anecdotal evidence were used to demonstrate how the evolving technological landscape has altered both the legal and social constructions of medical privacy in modern day America. In particular, the social and political climate precipitating the creation of the Health Insurance Portability and Accountability Act of 1996 illustrated the need for a federal standard of medical privacy protection in light of rapidly evolving technological capabilities – reflected in the legislation’s comprehensive structure. Finally, the efficacy of HIPAA was assessed in light of continuing technological advances and compared against contemporary public opinion regarding the threat of third-party privacy intrusion; this analysis indicated a need for more potent legal protection for medical information privacy despite a decreasing trend in the general public’s support for such measures.

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## Causes and Consequences of Ladybug (Coccinellidae) Washups in the Finger Lakes

ERIC DENEMARK

Under the supervision of Dr. John Losey  
Department of Entomology

We searched for and collected data on a phenomenon known as ladybug washups, in which large numbers of coccinellids aggregate on the shores of major bodies of water. Our field season lasted from 5/23/2008 until 8/12/2008 in the Finger Lakes Region of New York, United States. Ladybug diversity and survival at washups, as well as washup size and frequency were studied to help understand why these events occur. Lab tests were conducted to determine how long ladybugs can survive afloat. This information was used to estimate the duration of floating in the washups we observed. The frequency, composition, and duration of washups in the Finger Lakes supports the hypothesis that a weather condition known as a lake breeze forces coccinellids to fall into the water. These animals subsequently arrive on shore in large numbers. This study adds three new species to the growing list of coccinellids affected by this phenomenon.

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## The Role of Environmental Factors in the Northeastern Range Expansion of *Papilio cresphontes* (Lepidoptera: Papilionidae)

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Under the supervision of Dr. John Losey  
Department of Entomology

The Giant Swallowtail butterfly, *Papilio cresphontes* (Lepidoptera: Papilionidae), has been reported in New York State for nearly 150 years. A recent, rapid increase in its occurrences—especially along the periphery of its distribution range—has become an unexplained local phenomenon. This study examines several environmental factors that may influence its northeastern range expansion, and presents background information on the movement of *P. cresphontes* populations into New York State and adjacent Ontario. During fall 2008, field data were collected from a local larval population, and literature and historical records were used to investigate the state-wide range expansion of *P. cresphontes*. The field results indicate that *P. cresphontes* larvae are capable of withstanding multiple frosts, are dispersing to pupate, and face natural enemies in this region. The historical data illustrate a range expansion by the butterfly in a northeasterly direction, and a significant rise in recent *P. cresphontes* occurrences is observed. This suggests that populations of this butterfly will continue to appear in central New York and are likely to increase in numbers. Although the larvae may have adapted to endure cooler temperatures, other dynamics such as natural enemies and the indirect affects of weather on the larval host plant may influence the growth of local *P. cresphontes* populations.

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## Increasing Fungal Growth Rates of *Amylostereum areolatum* to Support Greater Production of the Nematode *Deladenus siricidicola*

ALEXANDRA Z. JIMENEZ

Under the supervision of Dr. Ann Hajek  
Department of Entomology

In 2004 the invasive woodwasp *Sirex noctilio* was found in the northeastern United States. Female wasps carry a symbiotic fungus *Amylostereum areolatum* and inject fungus, toxic mucus and eggs into pine trees. Larvae feed on the fungal-infested wood until they exit at maturity. In Australia, pine plantations were devastated by this wasp, but the nematode *Deladenus siricidicola* provided an effective means of biological control; this nematode is either parasitic on *S. noctilio* or feeds on *A. areolatum*. This nematode is mass produced on fungal cultures of a strain of *A. areolatum* called Aussie for use as a biological control agent in the southern hemisphere. Aussie is a fast grower and can supply the nematodes with their required supply of hyphal tips. To control *S. noctilio* in North America, the native strains of fungi must be able to grow as fast as Aussie. This study aimed to increase the growth rates of the North American fungal strains through the use of three novel types of media (green bean agar, hagem agar, and PDA with thiamine hydrochloride). Green bean agar increased the growth rate of the North American fungal strains but not to the rate of Aussie. Nematode growth trials were conducted to determine the number of nematodes needed on a fungal colony to produce a maximal end population of nematodes. The Aussie fungus on Hagem agar with an initial colony diameter of 3.0 cm can be inoculated with as few as 680 nematodes per plate to yield an optimum end nematode population.

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## Host Orientation and Attraction to Natural and Synthetic Odor Sources by the Malaria Vector, *Anopheles gambiae sensu stricto*, in Tanzania

CRISTINA J. MUNK

Under the supervision of Dr. Laura Harrington  
Department of Entomology

A novel semi-field system—a 100-meter long “tunnel”—was utilized to determine the range of attraction of the malaria vector *Anopheles gambiae sensu stricto* to three odor sources (carbon dioxide, a newly-developed synthetic blend mimicking human odor, and whole human odor). The goals of my honors research were (1) to rank the attractiveness of these odors to *An. gambiae s.s.*, and (2) to explore how odor blend attractiveness changed as a function of distance. The tunnel was used to test the efficacy of a novel behavioral assay—three-chambered “taxis boxes”—to indicate mosquito attractiveness or repellency to the same three odors. The mean number of mosquitoes recaptured did not significantly differ across various distances in the tunnel (20, 50, 70 and 100 meters), indicating that *An. gambiae s.s.* range of attraction is likely greater than Gillies and Wilkes’ (1968) estimate of 37-55m for *An. melas*. The taxis boxes have potential to be effective indicators of attractiveness and repellency; however, biasing factors must be rectified. This is the first study to report range of attraction of *An. gambiae s.s.* to carbon dioxide, human odor and a synthetic blend. The synthetic blend tested in this study has potential

for use in synthetic odor-baited traps, which could greatly enhance malaria vector surveillance programs and eliminate the need for human exposure to potentially infectious vectors.

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## Little Moth, Big Problem: A Flower-galling Parasite Affects the Development and Fitness of Its Host Plant

JESSICA L. WALDEN

Under the supervision of Dr. Robert Raguso  
Department of Neurobiology and Behavior

A galling organism alters the phenotype of its host plant in an intimate relationship where the galler modifies the plant's biology for its own benefit. Gallers that inhabit reproductive organs provide the potential for large fitness effects and therefore strong selective pressure on the plant to avoid, combat, or tolerate infestation. I investigated how the infestation of *Oenothera caespitosa ssp. caespitosa* (Onagraceae) flower buds by *Mompha definitella* (Lepidoptera: Momphidae) larvae affects bud development, floral phenotype and plant fitness. These experiments were conducted in natural populations in Bridger-Teton National Forest, Teton Co., Wyoming. The moth lays eggs on young buds and the larvae develop in the nectar tubes of growing buds. Infested buds become galls; they develop shorter, thicker nectar tubes and are more likely to abort than uninfested buds. If an infested bud blooms, it is likely to be missing parts of its corolla and/or be partially castrated. To estimate the fitness costs of infestation, I measured the seed set of infested and uninfested buds. As would be predicted, aborted buds and flowers with snapped styles had no female fitness. Overall, infested buds had lower seed set than uninfested buds. I also found that infested flowers have a very different floral display and less nectar than uninfested flowers. Thus, *M. definitella* appears to significantly alter the development and phenotype of the reproductive unit of its host *O. c. caespitosa* and impacts the fitness of infested plants.

## Socially-Constructed Landscapes: Evolving Governing Structures to Sustain Community Gardens

CASSANDRA B. BOSCO

Under the supervision of Dr. Peter Trowbridge  
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Communication and interaction are fundamental characteristics in the evolution of humanity. Towns and cities arise out of these necessities. Many people come together to build communities in order to form bonds. In the metropolitan setting where space is extremely limited, shared community gardens become the quintessential example of places that people use to reconnect with their physical surroundings and build social value. In more rural locations, people intentionally design shared spaces, yearning to rekindle communal living integral in urban environments. Cohousing developments are such places, which are founded upon the kinship ideal. Community gardens and cohousing developments are two disparate landscapes that exhibit the human need to connect. Physical layout comes secondary in these socially-constructed places; they are vehicles for cultivating strong relationships between people of shared values.

To better understand this phenomenon, this thesis will specifically explore three community gardens - the Liz Christy Bowery-Houston Garden, La Plaza Cultural, and 6BC Botanical Garden - in order to understand placemaking in action. Ongoing strategies that helped these communities develop “place” will be outlined and critically evaluated. For consistent comparison, each garden will focus on the evolution of their governance. Cohousing developments will be as a way studied to first understand how socially-driven organizations assemble themselves. This thesis will conclude that such places, out of the desire to improve, create more organized, hierarchical governing systems over time.

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## New England Town Greens: Preserving Landscape Identity

SKYLER M. CHICK

Under the supervision of Dr. Daniel Krall  
Department of Landscape Architecture

The two primary objectives of this research were to (1) explore the threats that are jeopardizing the landscape identity of New England town centers and especially town greens, and (2) to develop a methodology by which New England towns may assess development, how that development affects or manipulates its character, and the potential management strategies needed to preserve town greens.

Research into the early history and settlement patterns was undertaken as a tool for understanding the unique landscape identities of New England towns. An investigation of the historical background

established the role of New England town greens as the religious, governmental, and social center of New England towns. The implications of this analysis justified the exploration of possible preservation methods.

Case studies of four New England towns in eastern Massachusetts – Holliston, Natick, Wellesley, and Wayland – concluded the research. A study of their individual town greens addressed site orientation and layout, circulation, focal points, vegetation, and site amenities. Summaries of existing conditions were coupled with recommendations for improvements pertaining to the five design categories.

The conclusions drawn from these case studies may be used as examples of how other New England towns may address threats, their repercussions, and the management strategies necessary for mediating these threats.

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## Anthroportscapes

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How does the airport alter the performance of a city? How does the airport plug into the larger landscape of an urban region? What meaning does the airport create for the millions of people who fly through often without pause? A web based survey was used to ascertain a wider scope of public views on airports as well as gathering opinions on some of the critical questions surrounding their future. Namely should the airport be connected to its local region, then should the airport be opened up as a citywide destination to the public [or non-passengers], and finally should the airport become a forum of social networking? Synthesizing these responses with different readings on airports as well as a variety of observations a framework for analyzing and designing these environments emerged. By considering earlier models in an attempt to understand the evolution of airport typologies and their connection to the urban landscape the concept anthroportscape was developed. The anthroportscape is the democratic, resilient, organic, and sustainable progressive evolutionary pathway of the airport. As the focus of this honors thesis investigation applying this urban design framework to the southern Indian city of Hyderabad yielded many fruitful speculations for sustainable development of the city and region. This further reinforced the conclusion that airports can drive sustainable urban development. Landscape architects mediating between multiple scales of development will play a critical role in airport design. This new paradigm of design will involve a broader spectrum of designers, planners, and thinkers.

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## Competition Between Fountain Grass (*Pennisetum setaceum*) and Pili Grass (*Heteropogon contortus*) Under Varying Nutrient Availability

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*Pennisetum setaceum* is a prolific invader of dry forest environments in the Hawaiian Islands, an extremely endangered ecosystem due to land-use change, undulate grazing, and invasive species. A native Hawaiian grass, *Heteropogon contortus*, was once common in the understory in this system, but has been largely replaced by *P. setaceum*. Current restoration efforts have attempted to use *H. contortus* as a replanting after *P. setaceum* removal. However, success has been limited because of the competitive dynamics between the two species. I examined the effects of nitrogen and phosphorus availability on intra- and interspecific competition between the species using a density-constant competition experiment. *P. setaceum* produced significantly higher shoot biomass than *H. contortus* except when under N-limitation and had higher root:shoot ratios (R:S). Interestingly, based on shoot %N and  $\delta^{13}\text{C}$  values, *H. contortus* had higher stomatal conductance than *P. setaceum* in all treatments, suggesting that *H. contortus* exhibits a higher rate of water transport under common conditions. Further, when in competition with *P. setaceum*, *H. contortus* expressed significantly different foliar  $\delta^{15}\text{N}$  than when grown in monoculture, suggestive of some alteration in N cycling or transport. The combination of these results suggests *H. contortus* most effectively competes with *P. setaceum* when the limiting resource is a relatively labile nutrient like nitrate ( $\text{NO}_3^-$ ). Based on this study, *P. setaceum* is a much stronger competitor compared to *H. contortus* under most field conditions. However, the difference in competitive ability is smallest under N limitation suggesting restoration efforts using *H. contortus* will be most effective in environments with low nitrogen availability.

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## Habitat-Use Preferences of *Novisuccinea chittenangoensis* and *Succinea* sp. B.

BRIAN D. STILWELL

Under the supervision of Dr. Charles Smith  
Department of Natural Resources

Although the Chittenango Ovate Amber Snail (*Novisuccinea chittenangoensis*) was listed as threatened over twenty years ago, the body of research surrounding this imperiled species remains alarmingly modest. The majority of studies on *N. chittenangoensis* have focused on its taxonomy, anatomy, and population status. Little research has been conducted regarding this species' basic natural history and ecology. In this paper we examined the habitat-use preferences of *N. chittenangoensis* and a non-native, possible competitor snail, *Succinea* sp. B. Based on habitat observation data, which documented substrate type, moisture class, decay class, and spatial orientation, Chi-Squared tests of independence and goodness-of-fit were performed to evaluate possible habitat preferences and requirements. We found that *N. chittenangoensis* occurred more frequently on drier, non-living, organic substrates, suggesting either that *N. chittenangoensis* has a



preference for such substrates or that it is being forced onto such substrates through competitive exclusion with *Succinea* sp. B. In contrast, we found that *Succinea* sp. B occurred more frequently on living substrates, could tolerate higher moisture levels, and had a particular affinity for watercress (*Nasturtium officinale*). Given these results, we recommend the maximization of drier, non-living organic substrates at Chittenango Falls, NY, *N. chittenangoensis*' only remaining habitat. We further recommend that *Succinea* sp. B be aggressively removed from *N. chittenangoensis*' habitat to minimize competitive interactions. In order to advance the success of species management and recovery, we recommend future studies further evaluate these species' diets, competitive interactions, and habitat-use.

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## Analysis of Side-Looking Deployment of Hydroacoustic Transducers in Fisheries Science

ROLAND W. WANG

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Department of Natural Resources

Side-looking (SL) deployment of hydroacoustic transducers is an effective approach to manage the issue of the near-field effect that limits abundance estimation of fish near the surface (<2 m) when using down-looking (DL) deployment in acoustic surveys. However, determining appropriate target strength (TS) thresholds for SL is more difficult due to the greater variability of orientation of fish and thus greater variability in the TS compared to DL. In this paper, I derive appropriate TS thresholds for SL acoustics in two alewife (*Alosa pseudoharengus*) dominated lakes, one in New York and the other in Pennsylvania. I use *ex situ* TS distribution of alewife from a net cage experiment as well as *in situ* TS distribution of alewife from the lakes to determine the appropriate TS thresholds. With the thresholds applied, I explore the feasibility of using SL deployment as a fisheries assessment technique by comparing fish density estimates of SL with DL and multimesh vertical gill nets. DL and SL acoustic surveys were conducted at Cayuta Lake in October 13, 2008 and October 29, 2007, and at Silver Lake in October 14, 2008. In addition, vertical gill nets were set in the lakes for length (mm), weight (g), and distribution in the top 6 m. *Ex situ* net cage experiments were conducted in 2006 at Oneida Lake using 5 alewives. Results from the net cage experiment shows a TS distribution that is both wide and skewed to the right with more targets observed that are greater than -55 dB compared to *in situ* TS distribution at Cayuta Lake and Silver Lake. SL deployment at Cayuta Lake and Silver Lake observed more targets per km than DL deployment. The catches of alewife in the gill nets at Cayuta Lake in 2008 and 2007 were unevenly distributed with a greater proportion of alewife, both young-of-the-year (YOY) and adults, caught in the top 2 m. Catches of alewife in Silver Lake were more evenly distributed with an equal proportion of YOY alewife caught between 0-6 m, whereas the adults were only caught between 0-4 m. Hydroacoustic and vertical gill net abundance comparisons shows a positive correlation between gill net catch/hr with SL acoustics. However, the correlation between gill net and DL acoustics is negative. I conclude that this study demonstrates the importance of using SL and DL deployment of transducers in abundance estimation. Traditional gear like vertical gill nets should also be used in order to obtain accurate assessment of species and size structure. Further study of the TS distribution of alewife in net cages using SL deployment is needed to improve the determination of the appropriate TS thresholds for data analysis.

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## The Effect of Weight Reduction Through Dietary Restriction and Exercise on Competition Performance Among Division I Collegiate Wrestlers

KRISTEN M. GRAVANI

Under the supervision of Dr. Virginia Utermohlen  
Division of Nutritional Sciences

Purpose: To examine the effects of weight loss practices on performance, as measured by wins and losses, among varsity wrestlers.

Background: In the U.S., wrestlers compete at weights that are lower than their usual body weights, under the assumption that they will be more likely to win against people of lower weight. Wrestlers often resort to drastic measures (severe fluid and dietary restrictions, laxatives, and sauna suits) with potentially fatal consequences. The NCAA has promoted a method for wrestling weight calculation that potentially guides wrestlers' weight loss through "safe" dietary means, i.e. diet restriction. The majority of studies in this area have focused on fatigue and injury as negative outcomes, but the assumption that weight loss is a strategy for winning has not been properly examined.

Methods: Twenty-four wrestlers on Cornell's varsity wrestling team provided complete data, which included: BMI (measured as height and weight), weight losses practices obtained through questionnaire, and record of season wins and losses. The relationship of the physical parameters and weight loss practices to season wins over total individual contests was examined. Analyses were performed using JMP 5.01 (SAS Institute, Cary, N.C.).

Results: The ratio of wins to total contests was significantly lower among those who practiced dietary restriction (Chi-square = 6.789,  $p = 0.0092$ ). Multiple regression analysis showed weight class as the ultimate predictor of season wins/total ratio, with being in the middle group of weights having a negative effect on performance. Whether the wrestler used diet restriction or strenuous exercise as weight loss methods also had an influence on predicted wins ( $R^2=0.59$   $p=0.003$ ).

Conclusion: Dietary restriction during preseason significantly affects season wins/total contests for these wrestlers later on. Wrestlers competing in a middle weight classes are more likely to utilize dietary restriction during this period. The negative relationship between this NCAA sanctioned weight loss practice and performance indicates that the NCAA weight management program and current dieting habits of collegiate wrestlers stand to be improved.

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## The Effects of Ozone on the Spores and Vegetative Cells of Bacterial Milk Contaminants

MICHAEL BUFANO

Under the supervision of Dr. Kathryn Boor  
Department of Food Science

Shelf life extension of fluid milk products is a constant challenge and goal within the dairy industry. Ozone has shown to be an agent with potential for sterilization within dairy processing systems. Three stratified experiments were conducted to measure the effects of ozone on three selected microorganisms found in milk: *Bacillus thuringiensis*, *Bacillus pumilus*, and *Bacillus licheniformis*. These experiments measured: 1) the effect of ozone on the inhibition and destruction of the selected organisms, 2) the effect of ozone on the native bacteria found in milk samples and 3) the effect of ozone as a surface sterilizing agent on glass and stainless steel surfaces. The study revealed a significant inhibition ( $P < 0.05$ ) of all three selected cultures after 30 minutes of ozone exposure. Upon examining the effects of ozone applied directly to fluid milk samples, there was no significant impact on the samples ( $P > 0.05$ ) with ozone treatments. In surface sterilization analysis, the effects of ozone mimicked those of the first experiment on stainless steel surfaces, but showed mixed results on glass surfaces.

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## Statistical Clustering of U.S. East Coast Winter Storms Tracks

DEAN A. FOGARASI

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

Using a previously constructed climatology of East Coast Winter Storms (ECWS) from the 6-hourly NCAR-NCEP reanalysis dataset, an exploratory statistical technique, cluster analysis, was applied with the objective of discerning groups of storms whose tracks are especially similar. In order for the Cluster Analysis to be performed using simple, hierarchical methods, a novel measure of storm track similarity was created. The collection of storm tracks were found to form, to the best estimate, 6 or 7 clusters, indicating that the processes generating these storms tend to favor several regions and paths. The track clusters are not thought to be highly well-defined, due to some discrepancies between clustering solutions among the several different clustering methods applied.

With the track climatology now divided into groups of similar track, some of their meteorological properties were compared and no significant differences in minimum pressure or maximum intensification rates achieved were found between clusters. Then, the variability of ECWS tracks over time were examined on both intraseasonal and interseasonal scales using storm frequencies. The most significant findings show that during El Niño events, and particularly for strong El Niños, large increases in ECWS activity are seen in storms that track through the Carolina coast and offshore of the southeastern U.S.

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## Analysis of Stability Indices for Severe Thunderstorms in the Northeastern United States

ROBERT J. GOTTLIEB

Under the supervision of Mark Wysocki, Sr. Lecturer  
Department of Earth and Atmospheric Sciences

In operational forecasting, many indices are used to assess the stability of the atmosphere and predict the likelihood of severe thunderstorm development. One of the shortcomings of many of these indices is that they are mainly based on observations from the southern Plains. Severe thunderstorms can occur in the northeastern United States in conditions which significantly differ from those expected in the Plains. Few attempts have been made to modify these indices for thunderstorms in the Northeast. A new set of values specifically for use in the Northeast are computed.

The stability indices examined are the Showalter index, lifted index, SWEAT, K index, total totals, CAPE, CIN, and equilibrium level pressure. Thunderstorms which occurred between the months of June through August during 1998-2007 are used in this analysis. Upper air data from radiosondes at eight sites in the Northeast are used to calculate the new index values. These data are analyzed with respect to the presence or absence of severe thunderstorms within 150 km and  $\pm 3$  hours of a sounding. Using these criteria, there are 423 soundings which contained severe thunderstorms and 13,012 soundings which do not. Forecast skill is calculated for each index. The best predictor in most cases is the LI, with CAPE a close second. For most indices, the threshold which result in the best forecast indicate less instability than what is typically required in the Plains. Probability density functions and scatter plots are created to visualize the data for all soundings.

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## Characterization of *Enterococcus mundtii* Bacteriocin Immunity

GISELLE KRISTI P. GURON

Under the supervision of Dr. Randy Worobo  
Department of Food Science and Technology

Approximately 500 of the 2500 cases of Listeriosis are fatal, so there is a need to eliminate the threat of *Listeria monocytogenes* in foods, especially in ready-to-eat products. The use of bacteriocins, antimicrobial peptides produced by bacteria, has been investigated as a potential barrier to prevent the growth of *Listeria* in processed foods. A recently identified class IIa bacteriocin, produced by *Enterococcus mundtii*, is comprised of 43 amino acids and exhibits high inhibitory activity against *Listeria* spp. Mundticin L, produced by *E. mundtii* CUGF08, can also act against other *Enterococcus* spp., however, *E. mundtii* possesses self-immunity towards its own bacteriocin. In this study, the putative immunity gene, which is allegedly just downstream from the structural genes of the mundticin peptide and the ABC transporter, was attempted to be confirmed as the gene responsible for conferring immunity to the producer strain through subcloning and heterologous expression of the suspect gene. The plasmid DNA containing the putative immunity gene was digested with the

restriction endonucleases *Xba*I and *Hind*III, and subcloned into pMG36e, a Gram positive shuttle vector plasmid, and transformed into the mundticin-sensitive *Enterococcus faecalis* FSL 23-140. The immunity phenotype was determined in the transformed *E. faecalis* strain upon exposure to mundticin L.

## Innovative Application of Supercritical Fluid Extrusion (SCFX) in Yeast-free Bread Production

MELVANY A. KASIH

Under the supervision of Dr. Syed Rizvi  
Department of Food Science

Supercritical carbon dioxide (SC-CO<sub>2</sub>)-based extrusion is a technology that allows continuous dough production using a high-pressure extruder to mix and knead dough and SC-CO<sub>2</sub> to leaven it. Current bread manufacturing processes use yeast fermentation that requires fermentation time and space. In addition, 99.7% of alcohol produced through fermentation is released to the air, causing compliance issues with EPA's Clean Air Act. The objective of this study was to produce SCFX-leavened dinner rolls that have density comparable to that of commercial rolls.

Dough was fed to an extruder at 120 rpm, injected with 1.5% SC-CO<sub>2</sub>, rounded and baked at 180° C for 30 min. Bread density measurements were done using rapeseed displacement method. The data were analyzed using ANOVA and Dunnett's multiple range test (p<0.05). Data were presented as percent density reduction.

In the first part of the study, the effect of increased residence time from static mixer and reduced extruder screw speed was tested. In the second part, the effect of oil and steam dough surface layering was evaluated. In the third and fourth part, the effect of shortening, guar gum, sodium stearoyl lactylate, and small quantity of ethanol were investigated. Combining the findings from each part of the study, bread density was significantly lowered to 0.28±0.006g/cm<sup>3</sup> (p<0.05). The study suggested the potential use of SCFX technology in industrial bread production, offering benefits such as reduced processing time, increased production space, and absence of alcohol emissions.

## An Investigation of the 24 July 2008 New Hampshire Tornado

JENNIFER F. NEWMAN

Under the supervision of Dr. Stephen Colucci  
Department of Earth and Atmospheric Sciences

Most tornadoes in the United States occur in the region known as "Tornado Alley." However, the only tornado-related fatality during the entire month of July 2008 was caused by a tornado in eastern New Hampshire. The purpose of this study is to assess the abnormality of this tornado event — was

it simply its location that was unusual, or were the underlying meteorological processes of the storm environment fundamentally different?

A case study of the 24 July 2008 New Hampshire tornado was conducted to examine thermodynamic indices and synoptic-scale features. The results of this case study were compared to a case study of a July tornado in North Dakota, a region with a similar climatological peak in severe weather. Sounding-derived parameters from both these cases were compared to climatological averages to assess the normality of the storm environments of each case.

A sea-breeze influence is proposed to explain the existence of severe convective weather on 24 July 2008 in the apparent absence of significant instability. The evolution of several derived parameters, including Convective Available Potential Energy and equivalent potential temperature, is related to a persistent southeasterly sea-breeze, which may have created moisture convergence and localized instability.

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## A Climatology of 500 mb Closed Lows and Associated Precipitation in the Northeastern U.S.

LEON T. NGUYEN

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

Recent regional climate change research has indicated that precipitation across the contiguous United States has increased over the past few decades. An unpublished study by [Roberts \(2007\)](#) found that the frequency of extreme precipitation events associated with cutoff lows in the northeastern United States have increased. The current study sought to attribute increases in precipitation associated with closed upper lows to either 1) an increase in the number of closed lows, or 2) an increase in the average precipitation occurring near closed lows. A climatology of 500 mb closed lows was developed using an automated procedure, and precipitation data were analyzed using data from the U.S. Cooperative Observer Network.

Closed 500 mb lows were identified within a rectangular geographic region bounded by 35°N, 50°N, 65°W, and 90°W. To be classified as a closed low, the low was required to have at least one closed geopotential height contour of at least 30 meters greater than the height at the closed low center. Precipitation at weather stations located within 1.25° latitude and 1.25° longitude of the closed low center was attributed to the closed low and averaged over its life span. Statistical testing procedures were then conducted to evaluate whether a long-term trend existed in closed low frequency or the average precipitation occurring near closed lows.

No significant long-term trends in the frequency of closed lows were found in the evaluated region, but a significant increase in average precipitation near closed lows was found. This increase was particularly evident during the winter months. The increase could be attributed to increases in tropospheric water vapor due to increased global mean temperature.

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## A Study of 24-hour High Flow Events in Small Scale New York State Watersheds

ANDREW J. SHOOK

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

Small watershed streams respond rapidly to intense rainfall and can be an effective tracer for changes in intense rainfall climatology. Therefore, in this study of New York State's rainfall climatology, watersheds were limited to those with less than 150 square miles. In order to identify a trend in the data, stream gauges with a record of at least 40 years of continuous data were considered. Finally, gauges were used if they had location coordinates which allowed them to be mapped on Google Earth. Streams were then classified into urban, urbanizing, or rural urbanized categories.

To identify the most intense events for each stream, an equation that would compute a flow index was derived and used to rank the events within a stream. Criteria for consideration included 24-hour events with at least twice the flow on the event day as compared to the previous and following days. This isolates the high-rate events that we are most interested in. Snow pack created an issue by contaminating the flood data. Therefore, only storms from April through November were considered, and the end months were checked for lingering snow pack effects.

The top forty events for each site were ranked. There were no observable patterns between wet and dry years. This fact remained the same when the results were reproduced for the sets based on urbanization. When two sample sites were paired with rain gauges, a weak relationship between the heaviest rainfall events and the heaviest stream flow events was observed.

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## Analysis of Spring Frost and Fall Harvest in the Finger Lakes Vineyards

KRISTEN N. YEAGER

Under the supervision of Mark Wysocki, Sr. Lecturer  
Department of Earth and Atmospheric Sciences

The 2003, 2004, and 2005 harvests of two Finger Lakes vineyards are analyzed and cross-examined with meteorological data taken from nearby stations. Harvests are characterized as below normal particularly within the *v. vinifera* varieties of Cabernet Franc and Riesling. Minimum temperatures surrounding the final spring frost are graphed to see general trends and fluctuations. Taking into account vine capabilities and vineyard elevation and proximity to water, the two data sets are analyzed using line graphs to find a correlating relationship. A statistical linear regression function confirms that minimum temperature fluctuations surrounding the final spring frost and harvest totals are directly related, contributing to the loss of crops in the Finger Lakes Region of New York.

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## Leaf Removal Timing Effect on TDN (1,1,6-trimethyl-1,2-dihydronaphthalene) Potential in Riesling Juice

MISHA T. KWASNIEWSKI

Under the supervision of Dr. Justine Vanden Heuvel  
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TDN (1,1,6-trimethyl-1,2-dihydronaphthalene) is associated with “kerosene” aromas in some wines. Although higher concentrations of potential TDN are associated with cluster light exposure, the critical timing for fruit exposure has not been established. Fruit zone leaf removal was applied to *V. vinifera* cv. Riesling grown in the Finger Lakes region of New York State at three different timings: 2, 33 and 68 days past berry set (PBS), and an untreated control. The glycosylated fraction of the juice was hydrolyzed under acid conditions, and analyzed by GC-MS to determine the concentration of potential TDN precursors. Basic juice chemistry and vine growth were also quantified. The highest concentrations of bound TDN at harvest (208 ppb) were observed in the 33 day PBS treatment, compared with 68 days PBS (134 ppb), 2 day PBS (65 ppb) and control (60 ppb) treatments. Free levels of TDN in juice were below the detection threshold (<1 ppb). Increased bound TDN correlated with lower canopy density, as measured by the Enhanced Point Quadrat Analysis (EPQA) metric Occlusion Layer Number. The correlation was strongest for EPQA after the pre-veraison treatment ( $R^2 = 0.50$ ). Leaf removal at berry set resulted in increased vine growth as measured by pruning weight, reduced cropload, and EPQA. Berry set leaf removal reduced titratable acidity compared with the control, with lower cropload correlating with increased Brix ( $R^2 = 0.30$ ). These results suggest that leaf removal at berry set could be used by growers to increase Brix and reduce titratable acidity without increasing potential TDN concentration.

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## The Search for Novel Resistance Alleles: Screening Teosinte-Maize Introgression Lines for Resistance to Northern Leaf Blight

OLIVER O. OTT

Under the supervision of Dr. Rebecca Nelson  
Departments of Plant Pathology and Plant Microbe Biology, and Plant Breeding and Genetics

There has been little prior work done evaluating the potential of teosinte as a source of novel disease resistance to fungal pathogens. Teosintes are the ancestors of domesticated maize (*Zea mays* ssp. *mays*). All species of teosinte can form hybrids with maize, of which crosses of maize with *Z. mays* ssp. *mexicana* and *parviglumis* are the most common and fertile. For this study, a set of near isogenic lines (NILs) derived from five teosinte accessions were used to examine resistance to the northern leaf blight (NLB), caused by *Exserohilum turcicum*. The objective was to identify chromosomal segments introgressed from teosinte that affect the level of disease resistance when compared to the recurrent parent B73. Teosinte-maize introgression lines with enhanced resistance to NLB were identified, for both incubation period (IP) and area under the disease progress curve (AUDPC).



Some of the more resistant lines identified contain teosinte introgressions in locations that correspond to previously identified NLB QTL. Several lines with lesion types distinct from B73 for overall lesion size, the extent of purple coloring around lesions and other characteristics were also noted. Further work is needed to determine whether introgressions at recognized QTL loci carry alleles that are not found in maize germplasm pool. Work is also needed to determine whether teosinte chromosomal introgressions, which have not previously been associated with resistance, contain novel resistance QTL.

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## Expression of Linear and Cyclic Electron Flow Components in the Bundle Sheath Chloroplasts along the Developmental Leaf Gradient of Maize (*Zea mays*)

XIAN QU

Under the supervision of Dr. Klaas Van Wijk  
Department of Plant Biology

During plant photosynthesis, ATP can be produced in the chloroplast by linear electron flow (LEF), as well as cyclic electron flow (CEF). As a C4 plant, maize (*Zea mays*) utilizes two distinct cell types, known as bundle sheath (BS) and mesophyll (M) cells to facilitate the photosynthetic activity. BS cells function to fix the carbon dioxide in the form of reduced carbohydrates and carry out mostly CEF for ATP production. In contrast M cells act as a carbon pump and provide carbon dioxide in the form of the C4 acid malate to BS cells and use LEF for ATP production. BS and M chloroplasts develop and differentiate from base to tip. In this honors thesis, I tested the hypothesis that with progressive leaf development, levels of Photosystem II proteins (OEC23, OEC33, D1, CP47) involved in LEF decrease in BS chloroplasts, while CEF proteins (NDH-L and PGR5) in the BS chloroplasts increase. This serves to switch from linear to cyclic electron flow in the BS chloroplasts along the leaf developmental gradient. Additionally, I investigated relationships between mRNA and protein levels of the selected CEF and LEF components to understand transcriptional and translational controls. Proteins and RNA were extracted from BS strands isolated from four different leaf sections of 9 day old plants and analyzed by western blot and reverse transcript – polymerase chain reactions (RT-PCR). My analysis showed increased levels of mRNA and proteins of all measured components from base to the middle of the leaf, followed by additional increase or decrease towards the leaf tip. These results suggest both transcriptional and post-transcriptional control mechanisms in maize leaf development. My data also suggest that BS cells isolated near the tip were not fully differentiated at the sampling stage.

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## Student-Professor Interactions in Cameroon: Perceptions of Sexual Harassment and Gender Inequality

MOLLY A. BAKER

Under the supervision of Dr. Parfait Eloundou-Enyegue  
Department of Development Sociology

This is an exploratory study of the interactions of students and professors at the University of Yaoundé I and the École Normale Supérieure, in Yaoundé, Cameroon. Existing literature highlighted the importance of understanding perceptions of gender and power when studying their interactions. Unequal gender norms and asymmetrical power can lead to instances of sexual harassment on campus. It was hypothesized that professors and students would define normal professor-student relationships differently. The methodology included focus groups of students and professors, both male and female. Analysis was based on seven assumptions of professor-student interactions and sexual harassment. While both professors and students emphasized the importance of academics and mentorship in this relationship, when discussing intimate relationships between professors and students these two groups differed. Because of these different perceptions of intimate relationships there was also disagreement on the prevalence of sexual harassment on campus. These disparities can be a detriment to the quality of education and therefore the development of the country. After completing the research further studies that survey administrators, staff and parents are recommended.

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## Identity, Perception and Economic Behavior: Explaining Persistent Poverty

EMMETT W. MEHAN

Under the supervision of Dr. Thomas Hirschl  
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The dominant ideology regarding poverty in the US is one of individualism. Polls have shown time and again that the majority of people hold the opinion that impoverished individuals and families have the capability as humans to rise out of poverty but are not doing so because of individual failings. While structuralist arguments are also prevalent as a counter-argument, this study intends to analyze what the effects of the internalization of these or any ideology surrounding poverty have on its persistence.

By analyzing qualitative data obtained from nine focus group interviews, encompassing three sectors of society in three counties in upstate N.Y., we have uncovered several underlying attitudinal components that show various understandings of poverty. These understandings, once internalized, feed into the stigma or stereotypes surrounding perceptions of poverty, and have an affect on the behavior of both the affluent and the impoverished. This dichotomy in behavior, which is apparent

and observable to all in society, perpetuates the inherent and underlying attitudes that were analyzed in this study and were determined to play a role in the persistence of class distinctions.

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## Psychopathic Storytelling: The Effect of Valence on Self and Time in Psychopathic Language Use

REBECCA MORROW

Under the supervision of Dr. Jeffrey Hancock  
Department of Communication

This study used computerized textual analysis to examine the characteristics of stories about positive and negative events provided by 13 psychopathic and 38 non-psychopathic criminal offenders. Psychopathic offenders were expected to display linguistic characteristics consistent with narcissistic personality disorder and to display a greater degree of psychological distancing than non-psychopathic offenders. Their language use supported these predictions. Compared to non-psychopaths, psychopaths produced a higher rate of first person singular pronouns (“I”), and fewer first person plural pronouns (“we”), consistent with narcissism, and fewer past tense verbs but more present tense verbs when retelling positive stories, consistent with psychological distancing. The results suggest that a psychopath’s narcissistic personality and psychological distancing can be detected in language production.

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## Unintentionally Revealing Intent: A Linguistic Analysis of Premeditated Deception in Computer-Mediated Communication

NICOLE A. NUSSBAUM

Under the supervision of Dr. Jeffrey Hancock  
Department of Communication

The words that people use in their interactions can reveal important aspects of their intentions. As computer-mediated communication becomes more prevalent, identification of the linguistic cues to deceitful intentions will become increasingly important. This study investigated the changes in linguistic behavior of 114 participants through automated linguistic analysis of transcripts from a synchronous text-based setting. Participants played in competitive games for monetary incentives in which they would have the opportunity to betray their communication partners after their interactions. Participants with deceitful intentions were expected to display a greater degree of psychological distancing but produce reduced cognitive mechanism terms relative to truthful participants. Deceitful participants were also expected to engage in strategic linguistic behaviors to support their planned deception. Their language use supported these predictions. Compared to truth-tellers, liars produced a higher rate of first-person singular pronouns, consistent with psychological distancing, and avoided terms associated with cognitive processes. They also used fewer words concerning future and present tense, presumably in a strategic attempt to avoid discussion of their deception, and more assent words to appear more cooperative and agreeable. These results suggest

that evidence of deceitful intentions can be detected in linguistic production in computer-mediated communication.

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## Agrarian Change and Social Transformation in Mozambique: 1928-2006

TANYA R. OLSEFSKI

Under the supervision of Dr. Fouad Makki  
Department of Development Sociology

This honors thesis considers the main lines of agrarian transformation in Mozambique in the context of two major political and social transitions: from the period of late colonial rule to the post-independence socialist oriented policies under The Liberation Front of Mozambique (Frelimo); and from the latter to the market oriented set of policies that became dominant in the post-Cold War era. The primary focus is on the transition from socialist policies characterized by the creation of cooperatives, state farms, and communal villages; to market-led transformations characterized by a system of private property in land and a system of production and exchange for the market. In the process, I look at the IMF-imposed Structural Adjustment Program and the civil war with the Renamo (The Mozambican National Resistance) movement that was armed and backed by apartheid South Africa, in shaping the nature of this transition.

I find that the creation of cooperatives, state farms, and communal villages was not successful at integrating peasants and bringing together communities to increase production largely because the policies implemented did not reflect the needs and desires of the peasantry. They often were inimical to the situation many peasants found themselves in. I also find that the liberalization of the economy was laden with policies that were unfavorable to the peasantry. The privatization of the cooperatives and state farms was accompanied by the reduction of state funded projects such as the development of rural infrastructures and road networks that are crucial in linking peasants to marketplaces.

In the future, Mozambique will need to empower local communities and develop rural markets and infrastructure if it is to increase production and generate a positive dynamic of development that can improve rural people's livelihood and decrease levels of poverty.

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## Schooling, Educational Quality and Social Networks of HIV/AIDS Orphans in Zimbabwe

ANILA REHMAN

Under the supervision of Dr. Parfait Eloundou-Enyegue  
Department of Development Sociology

UNESCO data indicates that sub-Saharan Africa's total expenditure on education is less than that of a single country such as Germany, France, or the United Kingdom. These low budgets are further compromised by persistent political unrest and the growing burden of the HIV/AIDS crisis and its

resulting growth in the orphan population. This paper examines the schooling of HIV/AIDS orphans in Zimbabwe, including their enrollment, but also educational quality as it is influenced by social network. Quantitative analysis of national representative surveys and qualitative data from key informants and focus group findings are used to assess this relationship. Findings indicate that orphans are less likely to be enrolled in school than non-orphans in Zimbabwe. This provides insight into the state of inequality associated with orphanhood, bringing into question whether disadvantages faced by orphans can be buffered by education, or whether those disadvantages simply emerge in different forms of inequality within the educational system.

In addition to lower enrollment, the quality of education received by orphaned children is also inferior, since the HIV/AIDS pandemic has ruptured the structure of the traditional family network. My point of departure is that the quality of a child's educational experience comprises interactions in school, as well as in the home. Evidence from focus group discussions suggest that the quality of education received by orphans is compromised by transitions in their peer social networks. Social capital is crucial for orphaned children who often view their families and peers as a source of social support. Yet, the data show that orphans disproportionately interact with networks of friends that are age asymmetric. I conclude by developing theoretical perspectives about how networks of caregivers and disproportionately older or younger peers impact the quality of the overall educational experience of children in general, and AIDS orphans in particular. These differences in social networks are an understudied facet of the overall educational experience of orphans in Zimbabwe. Finally, a case study of World Vision is conducted to assess whether such institutions can function as an alternative provide orphans with extended networks to enhance their educational experiences. How the social networks of orphans compare to those of non-orphans can provide crucial insight into the orphan experience, and the need for policy revisions in this overlooked arena.

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## All Work No Play? : Asian American Females in Teenage Magazine Advertising & Editorials

JESSICA SHON

Under the supervision of Dr. Cliff Scherer  
Department of Communication

Advertisements have historically underrepresented minority women and portrayed them in stereotypical manners. Much research has found that these depictions have negative effects on their perceived body image and identity. This study focuses on the frequency and portrayal of Asian American females in advertisements and editorials for teenage magazines. The increase in the Asian American population and the prevalence of depression among young Asian American females warrants further research about this minority group. Using a content analysis I collected and analyzed 466 images from the most popular teen magazines. Each advertisement or editorial containing an Asian American female was selected and for each of these images, every fifth image of a presumably non-Asian model was also selected. All advertisements and editorials were coded for variables which included product categorization, environment, nature of relationships and beauty type. I hypothesize that Asian American females will be underrepresented in U.S. teen magazines when compared to their actual U.S. population. I also expect that Asian American females are more

likely to be depicted as “cute” and in advertisements or editorials with technology products, academic settings and non-social relationships. Through the results of this study I hope to gain better insight into the portrayal of Asian Americans in teenage magazines and the its potential impact on adolescent girls as well as greater society.

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## Effects of Watching Television Commercials on Snacking Behavior in an Adult Population

NISHANT J. TRIVEDI

Under the supervision of Dr. David Levitsky  
Division of Nutritional Sciences

Obesity in children and adults is reaching epidemic proportions, and snacking is hypothesized to contribute to the rise in sugar and fat consumption. Snacking behavior has been shown to be influenced by television, and food advertisements in particular, in children, adolescents, and obese (BMI >30 kg/m<sup>2</sup>) adults, however; no study has examined the effect food advertisements on snacking in a non-obese (BMI 17.95 < X < 24.9 kg/m<sup>2</sup>) adult population.

Our study included 26 subjects (19 females and 7 males) from Cornell University, ages 18-22. Participants were told that they would be rating two sets of 15 minute advertisements, with a period of one week between each set, on subjective measures. Snack food consumption was measured during non-food car commercials and food commercials.

Paired-T tests were used to analyze the data, as each subject served as his or her own control. The mean snack consumption was 21.96±5.08g during the non-food commercials and 27.58±5.62g for the food commercials. Mean snack consumption of male participants was 40.29±10.20g for the non-food commercials and 46.86±11.45g during the food commercials, a difference that failed to reach statistical significance. Female participants consumed an average of 15.21±5.18g during the non-food commercials, a value significantly greater than the 20.47±5.78g consumed during the food commercials.

Results indicate that viewing food advertisements does lead to increased snacking among an adult population ( $p < 0.04$ ), which is consistent with conclusions drawn from similar studies with children, adolescents, and obese adults.

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## The International Transmission of U.S. Monetary Policy: A Case Study of Korea

YOUNGSIK YOON

Under the supervision of Dr. Nancy Chau  
Department of Applied Economics and Management

This paper is an empirical investigation of the international transmission of U.S. monetary policy in South Korea. It combines modern mainstream macroeconomics in monetary transmission with various adjusted versions of the IS-LM model to estimate the relationship between U.S. monetary policy and the Korean economy. The Ordinary Least Squares analysis confirms the statistical significance of U.S. money supply, with other relevant factors, in determining Korea's output, exports, interest rate and money supply. The results are robust to an alternative measure of U.S. money supply while they vary slightly with the introduction of a time factor to possibly account for capital controls. This study adds to the current literature by extending the study period to cover over forty years of trade history between the U.S. and Korea.





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