

**K-State Graduate  
Research, Arts, and Discovery (GRAD)  
Forum**

Program Booklet

March 26, 2019  
K-State Student Union Courtyard

March 27, 2019  
Regnier Hall

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Graduate Student Council  
Graduate School  
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# **PROGRAM SCHEDULE**

## **MARCH 26**

### **Poster Sessions**

1:00 - 3:00pm	Poster presentations and judging Agricultural Sciences Biological Sciences Engineering, Math, and Physical Sciences Social Sciences, Humanities, and Education	<i>K-State Student Union Courtyard</i>
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## **MARCH 27**

### **Morning Oral Presentations**

9:00am – 12:15pm	Engineering, Math, and Physical Sciences	<i>2142 Regnier Hall</i>
9:15 – 11:30am	Biological Sciences 1	<i>2124 Regnier Hall</i>
9:45 – 11:30am	Agricultural Sciences	<i>2123 Regnier Hall</i>

### **Afternoon Oral Presentations**

2:00 – 3:45pm	Biological Sciences 2	<i>2142 Regnier Hall</i>
2:00 – 3:30pm	Interdisciplinary Research	<i>2124 Regnier Hall</i>
2:15 – 3:45pm	Social Sciences, Humanities, and Education	<i>1137 Regnier Hall</i>

### **Awards Ceremony**

4:30pm	<i>Ekdahl, Regnier Hall</i>
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## Oral Session Schedules

### **Engineering, Math, and Physical Sciences**

2142 Regnier Hall

9:00AM – 12:15PM

- 9:00 **AN INTRODUCTION TO CONFIGURATIONS SPACES WITH AN APPLICATIONS TO ROBOTS**  
*Keely Grossnickle*
- 9:15 **BIOLOGICALLY INSPIRED CATALYTIC COMPLEXES FOR THE REDUCTION OF NITROGEN**  
*Casey Howard*
- 9:30 **FINDING MODERN PRINTMAKING METHODS THROUGH OPTIMAL EXPERIMENTAL DESIGN**  
*Katharine Bossmann*
- 9:45 **SYNTHESIS OF AN ENZYME-MIMIC USING A MIXED-LINKER METAL-ORGANIC FRAMEWORK**  
*Kanchana Samarakoon*
- 10:00 **MULTIPLE CRITERIA DECISION MAKING MODEL FOR AGING IN PLACE**  
*Cristiane Kauer Brazil*
- 10:15 **MOLECULAR MOVIES FOR IMAGING THE TRANSIENT MOLECULAR GEOMETRIES OF LIGHT-INDUCED POLYATOMIC SYSTEMS**  
*Balram Kaderiya*
- BREAK**
- 10:45 **PURIFICATION OF HUMAN SERUM ALBUMIN FROM TRANSGENIC RICE**  
*Kseniya Sheshukova*
- 11:00 **SPANNING TREE MODULUS FOR SECURE BROADCAST GAMES**  
*Kapila Kottegoda*
- 11:15 **IDENTIFYING POTENTIAL CYBER-THREAT EVENTS BY EXTRACTING INTELLIGENCE FROM TWITTER STREAMS**  
*Avishek Bose*
- 11:30 **USING BLACK-BOX MACHINE LEARNING TECHNIQUES TO IDENTIFY SPATIAL DEPENDENCE IN OCCUPANCY DATA**  
*Narmadha Mohankumar*
- 11:45 **GHERRA- A BENCHMARK SUITE OF ANDROID APP VULNERABILITIES**  
*Joydeep Mitra*
- 12:00 **MOLECULAR CONTAINERS: STORAGE AND DELIVERY**  
*Nandini Sarkar*

**Biological Sciences 1**

2124 Regnier Hall

9:15AM – 11:30AM

9:15 **ULTRASONOGRAPHIC IMAGING OF THE MEDIAL GASTROCNEMIUS CROSS-SECTIONAL AREA DEMONSTRATE SIGNIFICANT RELIABILITY**

*Lauren Pacinelli*

9:30 **A NOVEL TRANSPORTER FROM RESISTANCE NODULATION DIVISION SUPER FAMILY PLAYS ROLE IN ANTIMICROBIAL RESISTANCE AND VIRULENCE IN S. AUREUS**

*Bibek Subedi*

9:45 **EFFECTS OF HEART RATE VARIABILITY MODULATION ON HIGH INTENSITY FUNCTIONAL TRAINING STRENGTH OUTCOMES**

*Brady Kurtz*

10:00 **UNDERSTANDING THE ROLE OF CDR20291\_0685 GENE IN PHASE VARIATION OF CLOSTRIDIUM DIFFICILE**

*Babita Adhikari*

**BREAK**

10:30 **CELL MEMBRANE IMPRINTED NANOPARTICLE FOR ENHANCED TUMOR TARGETED DRUG DELIVERY**

*Tuyen Nguyen*

10:45 **VACCINIA VIRUS INDUCED ALTERATION OF METABOLISM AND ITS ROLE IN HOST SHUTOFF**

*Anil Pant*

11:00 **ACCIDENTAL DISCOVERY OF A HUMAN MAMMALIAN RUBULAVIRUS 5 STRAIN**

*Brandi Feehan*

11:15 **RELIABILITY OF POSTURAL STABILITY ASSESSMENTS WITH AFFIXED DIAGNOSTIC ULTRASOUND**

*Jeffrey Williams*

**Agricultural Sciences**

2123 Regnier Hall

9:45AM – 11:30AM

- 9:45 **BIOFILM-FORMATION ABILITY OF *LISTERIA MONOCYTOGENES***  
*Ellen Mendez*
- 10:00 **LEXICON DEVELOPMENT AND SENSORY ANALYSIS OF A WIDE VARIETY OF POTATOES GROWN IN THE UNITED STATES**  
*Chetan Sharma*
- 10:15 **PASSIVE MODIFIED ATMOSPHERE PACKAGING CAN EXTEND THE SHELF LIFE AND MAINTAIN THE QUALITY OF LOCALLY PRODUCED TOMATOES**  
*Konstantinos Batziakas*
- 10:30 **SIGNIFICANCE OF TEMPERING METHODS ON WAXY WHITE SORGHUM MILLING AND FLOUR PROPERTIES**  
*Mohana Yoganandan*
- 10:45 **EMPLOYING ADAPTATION SIGNALS FROM ANCESTRAL WHEAT TO IMPROVE DROUGHT TOLERANCE IN BREAD WHEAT**  
*Elina Adhikari*
- 11:00 **LIFE STAGE-SPECIFIC DIFFERENCES IN MOBILITY OF TROGODERMA VARIABLE (COLEOPTERA: DERMESTIDAE) AFTER EXPOSURE TO LONG-LASTING INSECTICIDE NETTING**  
*Rachel Wilkins*
- 11:15 **ECTOPIC EXPRESSION OF A GLUTAREDOXIN GENE IN CORN INCREASES THE TOLERANCE AGAINST DROUGHT STRESS DURING REPRODUCTIVE STAGES**  
*Tej Man Tamang*

**Biological Sciences 2**

2142 Regnier Hall

2:00PM – 3:45PM

- 2:00 **FUNCTIONAL CONSEQUENCES OF GENETIC VARIATION: BIOCHEMICAL AND PHYSIOLOGICAL ADAPTATIONS TO EXTREME ENVIRONMENTS**  
*Nick barts*
- 2:15 **EFFECTS OF DROUGHT STRESS ACROSS POPULATION AND AGE IN WILD FOXTAIL MILLET SETARIA VIRIDIS**  
*Sam Sharpe*
- 2:30 **FINE-SCALE HETEROGENEITY IN SOIL CARBON DYNAMICS AS A RESULT OF WOODY ENCROACHMENT IN THE TALLGRASS PRAIRIE**  
*Kent Connell*
- 2:45 **METHANE OXIDATION IN NATIVE PRAIRIE SOIL**  
*Irosha wanithunga*
- 3:00 **LEGACIES OF HISTORIC CLIMATE SHAPE HOW TALLGRASS PRAIRIE ECOSYSTEMS RESPOND TO NOVEL PRECIPITATION REGIMES**  
*Caitlin Broderick*
- 3:15 **ECOTYPIC ADAPTATION OF ASCOMYCETES TO DROUGHT**  
*Kyle Ismert*
- 3:30 **EFFECTS OF FIRE AND HERBIVORY ON A SHRUB EXPANDING INTO TALLGRASS PRAIRIE**  
*Emily Wedel*

## **Interdisciplinary Research**

2124 Regnier Hall

2:00PM – 3:30PM

2:00 **ESTIMATING SPATIAL INTERACTION BETWEEN SOYBEAN POTENTIAL YIELD AND BEE'S SUITABILITY USING SATELLITE DATA**

*Dong Luo*

2:15 **SEEDING DEPTH AND CORN GRAIN YIELD AS INFLUENCED BY PLANTING SPEED AND DOWNFORCE SETTING ON ROW CROP PLANTERS**

*Sylvester Badua*

2:30 **EVALUATION OF SATELLITE- AND MODEL-BASED SOIL MOISTURE DATA IN THE UNITED STATES**

*Ameneh Tavakol*

2:45 **SEASONAL DYNAMICS OF MYCOBIOMES ASSOCIATED WITH THE BIOFUEL GRASS PANICUM VIRGATUM**

*Anna Kazarina*

3:00 **ACCURACY AND RESPONSE TIME OF PULSE WIDTH MODULATED AGRICULTURAL SELF-PROPELLED SPRAYER**

*Jonathan Fabula*

3:15 **BIOMASS PRETREATMENT BY MAGNESIUM OXIDE FOR REDUCING SUGAR DEGRADATION AND WATER CONSUMPTION IN ETHANOL PRODUCTION**

*Jun Li*



**Social Sciences, Humanities, and Education**

1137 Regnier Hall

2:15pm-3:45pm

- 2:15 **EXAMINING THE NARRATIVE PERSUASIVENESS OF THE 50 YEAR FARM BILL**  
*Jacob Miller*
- 2:30 **WHO AM I AND WHAT DO I DO AS A DESIGNER?" INTEGRATING LEADERSHIP SKILLS WITH BEGINNING DESIGN EDUCATION**  
*Dorna Eshrati*
- 2:45 **INTRODUCTION OF GREEK YOGURT AND ITS MARKET IMPACTS ON U.S. YOGURT INDUSTRY**  
*Elif Dilden*
- 3:00 **CROP DIVERSIFICATION AND SPATIAL HETEROGENEITY IN FOOD INSECURITY IN NIGER**  
*Manzamasso Hodjo*
- 3:15 **"THE FOUNDATION OF A SHORT MASS": REVISITING THE GENESIS OF BERNSTEIN'S MISSA BREVIS (1988)**  
*Patrick Dittamo*
- 3:30 **BLACK BUTTERFLYZ: MAKING BLACK WOMEN'S HEALTH A CAPITAL CONCERN**  
*Chris Omni*

## **Poster Titles and Presenters**

### **Agricultural Sciences**

K-State Student Union Courtyard

Judging: 1:00PM-3:00PM

**1. BREEDING STRATEGIES TO FIGHT A CEREAL KILLER**

*Paula Silva*

**2. ANTIOXIDANT PERFORMANCES AND EMULSIFYING ACTIVITY OF CORN GLUTEN MEAL HYDROLYSATE IN OIL-IN-WATER EMULSIONS**

*Yanting Shen*

**3. UNDERSTANDING THE SUCCESS OF AN INVASIVE POST-HARVEST PEST OF MAIZE IN A CHANGING GLOBAL CLIMATE**

*Hannah Quellhorst*

**4. SURVEYING SPECIALTY CROP GROWERS TO ASSESS INTEGRATED PEST MANAGEMENT EXTENSION NEEDS**

*Chandler Day*

**5. DYNAMICS OF SOYBEANS AND CATTLE PRODUCTION IN BRAZIL**

*Rebecca Maranhao*

**6. SOIL HEALTH OF LONG TERM WHEAT AND SOYBEAN ROTATIONS**

*James Lin*

**7. SENSORY AND VISUAL EVALUATION OF SIX DIFFERENT BEEF SHANK CUTS FROM ASIAN CONSUMERS**

*Wanjun Wu*

**Biological Sciences**

K-State Student Union Courtyard

Judging: 1:00PM-3:00PM

- 8. INVESTIGATION OF THE PREVALENCE OF SALMONELLA SPP IN UNITED STATES FEED MILLS**  
*Gabriela Magossi*
- 9. FERRIC PYROPHOSPHATE IN EXTRUDED, FORTIFIED RICE LEADS TO BETTER IRON OUTCOMES THAN FERRIC PHOSPHATE IN RATS**  
*Erin Ward*
- 10. REGULATION OF LEUCINE BIOSYNTHESIS AND A KEY NITROGEN ASSIMILATION GENE BY THE TRANSCRIPTION FACTOR LEUR IN ASPERGILLUS NIDULANS**  
*Joel Steyer*
- 11. PREVALENCE OF SALMONELLA SPP. ISOLATED FROM ENVIRONMENTAL FOOD SURFACES FROM VEGETABLE MARKETS IN CAMBODIA.**  
*Carla Schwan*
- 12. ANTICANCER DRUG LOADED HYBRID-EXOSOME FOR TUMOR TARGETED DRUG DELIVERY**  
*Sagar Rayamajhi*
- 13. OVEREXPRESSION OF THE PROTEASOME ACTIVATOR, BLM10, AFFECTS THE PROTEASOME LANDSCAPE**  
*Alicia Burris*
- 14. DETECTION, ISOLATION, CHARACTERIZATION and ANTIMICROBIAL TESTING OF SUSCEPTIBILITY OF SALMONELLA ENTERICA FROM WHEAT GRAIN SAMPLES**  
*Mori Atobatele*
- 15. GLYCEMIC RESPONSE TO TWO DOSES OF RESISTANT STARCH TYPE 4: A RANDOMIZED CONTROLLED CROSSOVER TRIAL**  
*Trevor Steele*                      *~WITHDREW~*
- 16. PREVALENCE AND QUANTIFICATION OF SALMONELLA SPP., E.COLI AND COLIFORMS ON VEGETABLES SOLD IN INFORMAL MARKETS IN CAMBODIA**  
*Karina Desiree*
- 17. IDENTIFICATION OF NRG1 AND UME6 INTERACTING PROTEINS DURING HYPHAL GROWTH INHIBITION IN CANDIDA ALBICANS**  
*Anuja Paudyal*

**Engineering, Math, and Physical Sciences**

K-State Student Union Courtyard

Judging: 1:00PM-3:00PM

**18. THEORETICAL STUDY OF NONADIABATIC RELAXATION DYNAMICS IN [Au<sub>25</sub>(SeCH<sub>3</sub>)<sub>18</sub>]-  
AND [Au<sub>13</sub>(P<sub>2</sub>H<sub>4</sub>C<sub>2</sub>H<sub>4</sub>)<sub>5</sub>Cl<sub>2</sub>]<sub>3+</sub>**

*Pratima Pandeya*

**19. ENHANCING ACETYL-TAG SYNTHESIS THROUGH METABOLIC ENGINEERING OF THE  
OILSEED CROP CAMELINA SATIVA**

*Linah Alkotami*

**20. PERFORMANCE ANALYSIS AND OPTIMIZATION OF MICRO-FIN CONFIGURATION IN A  
TUBE**

*Shima Soleimani*

**21. CORRELATING PLASMON DYNAMICS WITH NUCLEAR VIBRATION**

*Gowri Udayangani Kuda Singappulige*

**22. THE HIDDEN WATER AND ENERGY DEPENDENCY OF OUR DIGITAL SOCIETY**

*Md Abu Bakar Siddik*

**Social Sciences, Humanities, and Education**

K-State Student Union Courtyard

Judging: 1:00PM-3:00PM

**23. HEALTH MESSAGE PERSONALIZATION AFFECTING COFFEE BEVERAGE CONSUMPTION**

*Nicholas Gallivan*

**24. A PATTERN LANGUAGE FOR INCLUSIVE DESIGN IN PRIMARY EDUCATION**

*Katlyn Montague*

**25. ADVENTURE TO THE GREAT UNKNOWN: EXPLORING THE SEMANTIC CREDIBILITY OF UNNAMED AND ANONYMOUS SOURCES**

*Holly Speck*

**26. CULTURAL DIFFERENCES IN ATTENTIONAL SELECTION AND VOLITIONAL CONTROL DURING FILM VIEWING**

*Taylor Simonson*

**27. DISSEMINATION OF TEXTILE AND APPAREL ENVIRONMENTAL INFORMATION: IS FACEBOOK POTENTIALLAY ENGAGING?**

*Sarif Patwary*

**28. BACK TO THE DRAWING BOARD: EXPLORING DRAWING AS A PATH TO EXPAND IMAGINATION AND CREATIVITY**

*Madison Dalke*

**29. A NEW NUTRITION TRACKING SYSTEM IMPACTS COLLEGE STUDENTS' EATING PATTERNS AND PHYSICAL ACTIVITY BEHAVIORS**

*Yanli Wang*

**30. PARENT-CHILD SYNCHRONY AS A PREDICTOR OF DIETARY RESEMBLANCE IN THE FAMILY, LIFE, ACTIVITY, SUN, HEALTH, AND EATING (FLASHE) STUDY**

*Kelsey Casey*

**31. CUSTOMER MISTREATMENT AND SOCIAL MEDIA MANAGER JOB SATISFACTION AND BURNOUT**

*Jana Thomas*

## Oral Presentation Abstracts

### Engineering, Math, and Physical Science

#### AN INTRODUCTION TO CONFIGURATION SPACES WITH AN APPLICATION TO ROBOTS

Keely Grossnickle

*Department of Mathematics, College of Arts and Sciences*

**BACKGROUND AND PURPOSE:** Given a number of robots in a multi-level warehouse, there are obvious safety precautions to keep the robots from running into each other as well as weight concerns on the building. How can one build an algorithm for the movements of these robots? **METHOD:** One vital piece of information needed build such an algorithm is the complexity of the space, which can be found using an area of mathematics called *Topology*. One type of space studied in Topology is called Configuration Spaces. While Configuration Spaces can be studied in any dimension, we will focus on Configuration Spaces in 3-dimensional space, that is, configurations of  $n$  distinct, labeled points in the xyz-plane. A closely related space to Configuration Spaces is Non- $k$ -Equal Configuration Spaces, where instead of having all  $n$  points distinct, we only require that  $k$  points do not collide. Looking at a topological invariant called *Homology* can then give some of the needed information to find the complexity of a space. **RESULTS AND CONCLUSION:** I defined and studied a new structure on the Homology of Non- $k$ -Equal Configuration Spaces, yielding a new relation not previously known. This helps further understand this space, which has many applications to other questions in Topology and to real world problems such as robots in a multi-level warehouse.

#### Biologically Inspired Catalytic Complexes for the Reduction of Nitrogen

Casey Howard Ackley and Dr. Peter Sues

*Department of Chemistry, College of Arts and Sciences*

**BACKGROUND AND PURPOSE:** Climate change has become one of the most important topics talked about today. A large contributor to climate change are greenhouse gas emissions coming from fossil fuels. Because of greenhouse gas emissions, the Earth's atmospheric temperature is projected to increase by 1.5°C by the year 2040. Higher temperatures will likely cause a longer growing season in the Midwest, which would be a major contributor to a decline in productivity. Droughts, forest fires, flooding and other natural disasters are also hypothesized to be consequences of climate change and greenhouse gas emissions. In order to halt these negative impacts, alternative fuel sources must be explored. Ammonia is a favorable choice because it will release nitrogen gas as a byproduct, and it has very similar characteristics to petroleum gas. They are both stored, transported, and handled very similarly, which would make the transition to ammonia fuels much easier. Current production of ammonia is unsustainable so new methods for making this potential fuel are needed. Many scientists have used inspiration from an enzyme called nitrogenase to design catalysts that will produce ammonia from nitrogen. **METHOD:** Inspired by the Love group, a calixpyrrole catalyst will be synthesized using a ferrocene backbone to aid in electron transfer. **RESULTS AND CONCLUSION:** While working on the synthesis of the targeted calixpyrrole ligand, two additional ligands were discovered. The three different ligands that can potentially be used to synthesize ammonia reduction catalysts will be presented.

## FINDING MODERN PRINTMAKING METHODS THROUGH OPTIMAL EXPERIMENTAL DESIGN

Katharine Janik Bossmann<sup>1</sup>, Jose Covarrubias<sup>2</sup>, Stefan H. Bossmann<sup>2</sup>, and Jason Sculla<sup>1</sup>

<sup>1</sup>*Department of Art, College of Arts and Sciences;* <sup>2</sup>*Department of Chemistry, College of Arts and Sciences*

**BACKGROUND AND PURPOSE:** Printmaking is a fine art in which artists use acids and oxidants to etch copper, or other metal plates, to create an image which will then be printed on paper using ink and a manual printing press. This method uses materials (ferric chloride, hydrochloric acid and nitric acid) that are harmful to humans and the environment. In this NEA-funded project we wanted to find a way to provide artists with an innovative method for creative expression using electro-etching techniques that have long been used in the electronics and biotech industries. **METHOD:** Using Optimal Experimental Design methodology, we designed experiments varying the amounts of copper sulfate, voltage, current and time to find the best possible electro-etching method that is safer and environmentally friendly, but also meets the high artistic standards which are necessary for this to be accepted in the Fine Art community. **RESULTS/FINDINGS:** The experiments provided a range of etches that led to further fine-tuning of our process. The Matrix created with the Doehlert Method led to the best possible combination of materials to build a catalog of mark making which will guide the artists in their work using this new process. Using Atomic Force Microscopy (AFM), the actual physical channels that were formed during the etching processes were imaged and compared. **CONCLUSION:** The optimized electro-etching method proved to be superior to classical acid etching intaglio printmaking.

## SYNTHESIS OF AN ENZYME-MIMIC USING A MIXED-LINKER METAL-ORGANIC FRAMEWORK

Kanchana Samarakoon, Christopher Satterfield, Mechelle McCoy, Daniel Pivaral-Urbina and Tendai Gadzikwa

*Department of Chemistry, College of Arts and Sciences*

**BACKGROUND AND PURPOSE:** Presented herein is progress towards the synthesis of a solid-state enzyme mimic. Enzymes are Nature's best catalysts and they can make chemical reactions millions of times faster. Existing synthetic structures have failed to meet all the requirements of an enzyme mimic because these requirements are generally incompatible with each other. An adequate enzyme possesses i) a reactive center isolated inside a cavity with a specific size and shape, ii) different chemical groups within the cavity, iii) and flexibility that allows the cavity to adjust when needed. In this work, we have proposed to use metal-organic frameworks (MOFs), as a platform for making enzyme mimics. MOFs are well-defined, crystalline materials with large cavities, made up of metal centers connected by organic molecule linkers. Here is where you say that in theory these cavities can be uniformly decorated with multiple, flexible functional groups so that they resemble enzymes, and that you will present your work in that direction. **METHOD:** A MOF material is synthesized using two different organic linkers that have independently reactive groups. The reactive groups of each organic linker are reacted via carefully selected organic reactions. **RESULTS:** KSU-1, a MOF with big cavities and two independently reactive organic linkers at precisely defined positions was synthesized. The subsequent independent and quantitative reactions on the different organic linker resulted in a uniformly bifunctional MOF. **CONCLUSION:** These results have introduced a methodology in which we can use MOFs as a platform to synthesize enzyme-mimics by generating molecular cavities that are precisely functionalized with multiple chemical groups.

## MULTIPLE CRITERIA DECISION MAKING MODEL FOR AGING IN PLACE

Cristiane Kauer Brazil

*Department of Industrial and Manufacturing Systems Engineering, Carl R. Ice College of Engineering*

**BACKGROUND AND PURPOSE:** Aging in place is a desire of almost everyone, but sometimes just not possible. Part of the natural aging process includes decreasing of mental and physical capabilities, sometimes to an extent that living on your own is not possible anymore. One of the hardest decisions for an elderly person and its family is whether it's safe or not to remain aging in their own homes. So far, this decision making has been very subjective. This project aims to develop a model with an informed decision making process. **METHOD:** Research was done to review what is needed to live independently and what indexes and tests are available to assess this information. Two main points are approached: from subject criterion and from site criterion. Clinical Dementia Rating, Instrumental Activities of Daily Living and a physical test will assess subjects' capability. Subject's desire regarding the alternatives along with closeness to specialized medical care, cost and safety will be analyzed from the site's perspective. The multiple criteria decision making method TOPSIS was selected to combine all attributes and provide a unique solution. **RESULTS AND CONCLUSION:** The model created provided an informed decision that helps to reduce the weight of making the subject leave or stay home, focusing on maximizing subject's safety and happiness, while minimizing costs. Further research should be done to assess dependency between variables and understand what should be the weight of each criteria, testing indexes and parameters using real data.

## MOLECULAR MOVIES FOR IMAGING THE TRANSIENT MOLECULAR GEOMETRIES OF LIGHT-INDUCED POLYATOMIC SYSTEMS

Balram Kaderiya, Kanaka Raju P., W.L. Pearson, Xiang Li, Travis Severt, Farzaeh Ziaee, Kurtis Borne, Yubaraj Malakar, I. Ben Itzhak, Daniel Rolles, and Artem Rudenko

*Department of Physics, College of Arts and Sciences*

**BACKGROUND AND PURPOSE:** Imaging of transient geometries is essential for the study of the photo-induced chemical processes (bond formation and breaking, control of concerted elimination pathways) and hence, important for the understanding of the complicated dynamics of polyatomic system. Here, we use halomethanes ( $\text{CH}_2\text{I}_2$ ,  $\text{CH}_2\text{ICl}$ ) as the polyatomic molecular target for the study of imaging of the geometries of the intermediate states in different fragmentation channels. **METHOD:** The experimental setup is based on the cold target recoil ion momentum spectroscopy combined with pump-probe technique for ultrafast measurements. The analysis is based on measurement of fragments from the three-body breakup channel induced by the pump & probe (800 nm, 25 fs,  $2\text{-}5 \times 10^{14} \text{ w/cm}^2$ ) pulses. **RESULTS/FINDINGS:** The time-resolved information on the kinetic energies (KE) and emission angles (" $\theta$ ") measurement of the ionic fragments are used to take the snapshots of the fragments belonging to the different dissociation pathways. **CONCLUSION:** Doing so, we are able to separate different dissociation pathways including the one involving halogen molecule formation in an intuitive fashion, which is a big challenge for polyatomic molecular systems. Similar 3-body analysis method can be applied for the understanding of the complicated dissociation pathways of other polyatomic molecules.



## PURIFICATION OF HUMAN SERUM ALBUMIN FROM TRANSGENIC RICE

Kseniya A. Sheshukova and Lisa R. Wilken

*Department of Biological and Agricultural Engineering, College of Engineering*

**BACKGROUND AND PURPOSE:** Transgenic plant systems have successfully been used to express recombinant proteins, including rice seed-expressed human serum albumin (rHSA). The development of an efficient extraction and purification process would allow rHSA to be used for various medical applications without the risk of viral contamination. To develop an integrated process, the effect of extraction conditions on subsequent purification must be evaluated. **METHOD:** Previous studies identified three extraction conditions that offer distinct advantages such as rHSA purity (pH 4.0), concentration (pH 6.0), or a compromise of both (pH 4.5) that were evaluated further using anion exchange chromatography (AEX). The effect of extraction conditions on purification using AEX was evaluated using batch adsorption and dynamic binding studies by the ÄKTA chromatography system. Affinity chromatography and Bradford microplate assay was used to analyze rHSA purities and yields. **RESULTS/FINDINGS:** Batch adsorption determined that a 5 min residence time and low binding conductivities ( $\leq 6$  mS/cm) provided favorable rHSA binding to AEX resin. Dynamic binding capacities were determined to identify suitable purification conditions for each extract. pH 4.5 extract provided the most desirable results ( $>95\%$  purity and 76% yield). **CONCLUSION:** An integrated process for purification of rHSA from rice flour was developed with acceptable purities and yields. Future work should include adjusting elution parameters to further improve purity, testing the biological activity of purified rHSA, and an economic evaluation.

## SPANNING TREE MODULUS FOR SECURE BROADCAST GAMES

Kapila Kottegoda, Nathan Albin, and Pietro Poggi-Corradini

*Department of Mathematics, College of Arts and Sciences*

**BACKGROUND AND PURPOSE:** The theory of p-modulus provides a general framework for quantifying the richness of a family of objects on a graph. When applied to the family of spanning trees, p-modulus has an interesting probabilistic interpretation. In particular, the 2-modulus problem in this case has been shown to be equivalent to the problem of finding a probability distribution on spanning trees that utilizes the edges of the graph as evenly as possible. In the present work, we use this fact to produce a game-theoretic interpretation of modulus by employing modulus to solve a secure broadcast game. **METHOD:** First we establish the connection between modulus and the broadcast game. Then the probabilistic interpretation of modulus and game theory are used to establish necessary and sufficient conditions for Nash equilibria of the game. **RESULTS/FINDINGS:** We have proved necessary and sufficient conditions for the Nash equilibria. Then we proved that the optimal distribution for modulus yields optimal mixed strategies for both players of the broadcast game. We have also found that modulus can be computed using the broadcast game. **FUTURE RESEARCH:** We plan to implement a new algorithm for modulus based on the broadcast game. In general, the optimal distribution for modulus is non-unique, and the set of optimal distributions forms a convex polytope. We plan to study this polytope carefully, because it provides a better insight about the graph structure.

## **IDENTIFYING POTENTIAL CYBER- THREATS BY EXTRACTING INTELLIGENCE FROM TWITTER STREAMS**

**Avishek Bose**, Vahid Behzadan, Carlos Aguirre, and William Hsu  
*Department of Computer Science, College of Engineering*

**BACKGROUND AND PURPOSE:** This research addresses the problem of identifying cyberthreat events, such as security vulnerabilities and attacks that are described in social media retrieved by scraping text and metadata from social network sites. Our goal is to trace cyberthreat events by finding the names of specific targets, attackers, and means of attack in the text and metadata, which is a challenging task because of the massive numbers of messages posted to social media like Twitter. Cyber attackers commit their attacks by exploiting system vulnerabilities secretly, but it is also common that both attackers and affected bodies also share relevant messages publicly on Twitter. Therefore, analyzing Twitter streams can provide valuable insights about emerging threat events before systems' attacks occur. **METHOD:** Detecting and showing the significance of detected events with subevents for each individual event in specified time intervals, we apply several steps such as document vectorization for document similarity measurement, user profiling and topic liveliness for event ranking, hashtag processing for event labeling, etc. on our filtered tweet dataset that is collected based on some initial seeds. **RESULTS/FINDINGS:** We experimented with a supervised approach (CNN) earlier on our annotated data set which worked very well on classifying distinct threat types. We are conducting comparative experiments between our newly-implemented framework and existing baseline systems. **CONCLUSION:** To the best of our knowledge, ranking events from the Twitter data streams to detect cyber threat have not been studied yet. So, we are identifying cyberthreat events incorporating a new adaptive ranking method to rank those using unsupervised machine learning algorithms.

## **USING BLACK-BOX MACHINE LEARNING TECHNIQUES TO IDENTIFY SPATIAL DEPENDENCE IN OCCUPANCY DATA**

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**BACKGROUND AND PURPOSE:** In ecology, occupancy data are a contaminated binary response that is used to map the presence or absence of a species. Models for occupancy data are used to estimate the occurrence of a species, where the true presence of a species is a function of a spatially varying process. In the standard spatial occupancy model, most researchers assume that the spatial component is a Gaussian process. This assumption leads to an inability to identify nontraditional spatial dependence such as discontinuities and abrupt transitions which are common in ecological data. Bayesian machine learning techniques have the potential to identify non-traditional spatial structure, but these technologies do not account for contamination in binary response. **METHOD:** We embed Bayesian machine learning methods into the hierarchical occupancy models to account for non-traditional spatial dependence and contamination in the binary response. We conduct a simulation experiment by selecting a few commonly encountered cases of traditional and nontraditional spatial dependencies in ecology and include an application of our method using camera trap data on the Thomson's gazelle in Tanzania. **RESULTS/FINDINGS:** The simulation results show that our approach captures nontraditional spatial dependence in the latent occurrence process. However, we are in the process of assessing the remaining experimental work and the application using data on the Thomson's gazelle.

## **GHERA- A BENCHMARK SUITE OF ANDROID APP VULNERABILITIES**

**Joydeep Mitra**

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**BACKGROUND AND PURPOSE:** Android captures more than 75% of the smartphone market share and its official app market has more than 2 million apps. Vulnerabilities in Android apps lead to security issues that can be exploited to cause harm to the end-user. Consequently, a lot of effort has gone into developing tools and techniques to automatically detect vulnerabilities in Android apps. However, there are no comprehensive up-to-date benchmarks, that can be used to rigorously evaluate existing vulnerability detection tools and techniques. Consequently, we developed a benchmark suite, Ghera, that captures 56 (known and some unknown) vulnerabilities that occur in Android apps. **METHOD:** We discovered these vulnerabilities by studying the official Android documentation, examining the source code of real-world apps and the Android platform, and investigating known vulnerability reports. We encoded these vulnerabilities in the form of verifiable benchmarks. Each benchmark has a good (benign) app with a vulnerability, a bad (malicious) app that exploits the vulnerability, and a secure app without that vulnerability. **RESULTS/FINDINGS:** Ghera can be used as an educational resource to understand Android app security. Based on an empirical study of more than 100K real-world apps, we established that Ghera benchmarks are representative of real-world apps. Therefore, Ghera can be used to evaluate the effectiveness of vulnerability detection tools. We used Ghera to evaluate and compare the effectiveness of 14 vulnerability detection tools and discovered that all tools combined detect only 30/56 vulnerabilities in Ghera. **CONCLUSION:** Ghera can help build secure Android apps, which is necessary to ensure the safety of the end-user.

## **MOLECULAR CONTAINERS: STORAGE AND DELIVERY**

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**BACKGROUND AND PURPOSE:** Tumor cells are the rapidly multiplying cells and with higher consumption of food, it increases the metabolism. The increase in metabolism leads to heartburn and acidity and hence decreases the pH. The purpose of this research is to design a molecular container or a capsule which can store the drug molecules and specifically release it to the tumor cells. These molecular containers are known as cavitands which are bowl-shaped molecules with cavities, that are capable of storing guest molecules through a variety of interactions. There are various applications of the cavitands as a molecular container and all these are characteristic of the defined space, volume and functional groups. **METHOD:** In this study, we focus our efforts mainly on how we can change the storage space of these cavitands, and different methods were used to capture the structure of the containers, the number of guests it can store and sensitivity towards pH. **RESULTS/FINDINGS:** These molecular containers were found to have varied storage space and were exclusive towards encapsulation and the number of guests it can store. **CONCLUSION:** These containers can be meticulously designed to release the drug at a particular pH. The molecular containers can be used as a Trojan Horse to hide the drug molecules and under triggered pH, it can precisely release the drug.

**ULTRASONOGRAPHIC IMAGING OF THE MEDIAL GASTROCNEMIUS CROSS-SECTIONAL AREA DEMONSTRATE SIGNIFICANT RELIABILITY**

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**BACKGROUND AND PURPOSE:** Ultrasonography (US) is an affordable method for investigating musculoskeletal structures within humans and animals alike. Due to the tapered structure of the human low leg, US is rarely used to evaluate the medial gastrocnemius (MG) muscle. This study investigated the reliability of identifying a region of interest (ROI) and panoramic US cross-sectional area (CSA) images of the MG. **METHODS:** Seventeen females (mean±SD: age=19±1.2 years) volunteered on 2 non-consecutive days at the same time (±2h). Lower leg circumference was measured 10cm distal to the tibial tuberosity. The posteromedial one-third of this measurement was identified as the ROI for US assessments. With participants in a prone position on an examination table, an US probe was maneuvered from the lateral to the medial aspect of the low leg using a fabricated guide, to capture muscle CSA. All US scans were analyzed using a third-party image analysis software. Reliability of ROI and CSA were determined using intraclass correlation coefficient (ICC, model 2,k) and standard error of measurement (SEM) reported as a percentage (SEM%). Systematic variability was examined using separate one-way repeated measures analyses of variance (ANOVA). **RESULTS:** The ANOVA indicated no systematic variability in either dependent variables (P>0.05). The ICC and SEM% for ROI and CSA were 0.99 and 1.76%, 0.94 and 5.01% respectively. **CONCLUSIONS:** These findings demonstrate the techniques utilized to identify the ROI and CSA measurements of the MG may be consistent and reliable for assessing structural characteristics of the MG despite the tapered anatomy of the low leg.

**A NOVEL TRANSPORTER FROM RESISTANCE NODULATION DIVISION SUPER FAMILY PLAYS ROLE IN ANTIMICROBIAL RESISTANCE AND VIRULENCE IN *S. AU***

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**BACKGROUND:** Bacterial efflux pumps are membrane proteins that extrude antimicrobial agents out of the cells. Resistance Nodulation Division (RND) superfamily is an important family of such pumps including AcrAB-TolC of *E. coli*, a prototype of bacterial efflux pumps. Despite being well studied in numerous Gram-negative bacteria, clinical relevance of RND efflux pumps in *S. aureus* is still poorly characterized. In this work, we hypothesized that AcrB, an RND protein in *S. aureus*, is involved in antimicrobial resistance and increased pathogenicity of *S. aureus*. **METHOD:** To determine the significance of AcrB in *S. aureus*, we constructed *acrB* deletion mutants in two genetic backgrounds (methicillin sensitive and resistant strains) using allelic replacement method, verified the mutations by PCR and evaluated their properties. **RESULTS:** The mutants from both backgrounds show significantly lower MIC for several antimicrobials, and this property reversed in plasmid borne complemented strains. Additionally, the *acrB* mutants had defective growth rate and more pronounced autolytic activity. *S. aureus* AcrB can be detected in its membrane protein fractions by Western blot. Interestingly, despite having low (22.3 %) homology with *E. coli* AcrB protein, *S. aureus* AcrB can be superimposed with the crystal structure of *E. coli* AcrB and complements *E. coli* *acrB*- mutant. **CONCLUSION:** Taken together, *S. aureus* AcrB is a functional MDR efflux pump and may have the additional role(s) during pathogenesis which remains to be determined in animal models.

## EFFECTS OF HEART RATE VARIABILITY MODULATION ON HIGH INTENSITY FUNCTIONAL TRAINING STRENGTH OUTCOMES

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**BACKGROUND AND PURPOSE:** High Intensity Functional Training (HIFT) involves completing concurrent aerobic and resistance training functional movements at high intensity with the goal of increased fitness. We examined the effectiveness of using daily heart rate variability (HRV) status to modulate training intensity and increase performance outcomes. **METHOD:** Participants (N=55) were healthy adults not participating in a structured exercise program. Participants were randomly assigned to either HIFT (n=29, age=24.1±4.1 years, 41.4% male) or HIFT-HRV (n=26, age=23.7±4.5 years, 53.8% male) groups. Both groups underwent an 11-week HIFT protocol and recorded HRV daily via validated mobile app. HIFT-HRV participants' exercise was modulated by reducing rate of perceived exertion based on their daily HRV statuses. Maximal strength was tested using the squat, overhead press, and deadlift in kg at baseline, midpoint, and post-intervention. **RESULTS:** There were no differences in intervention fidelity between groups, which included adherence to HIFT (p = .21) and providing daily HRV data (p = .75). The HIFT-HRV group had their training modified 17.12 ± 6.75 days. Additionally, one-way RM-ANOVAs indicated significant increases in the squat (HIFT+14.10±1.63 kg, F=55.38, p<.001; HIFT-HRV=+13.25±1.77, F=50.87, p<.001), overhead press (HIFT=+3.75±.93, F=11.82, p<.001; HIFT-HRV=+4.37±.87, F=10.72, p<.001), and deadlift (HIFT=+15.40±2.51, F=28.7, p<.001; HIFT-HRV=+15.62±2.75, F=27.7, p<.001) within each group. Independent samples t-tests showed no differences in strength (p=.41-.99) between groups. **CONCLUSION:** Results suggest that HIFT-HRV produced equal increases in strength while having reduced training intensity for over half of the training days. HRV appears to be an effective means of modulating HIFT to increase strength outcomes.

## ROLE OF CDR20291\_0685 IN SPORULATION INITIATION OF *CLOSTRIDIODES DIFFICILE*

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**BACKGROUND AND PURPOSE:** *Clostridioides difficile* causes life-threatening inflammation of the colon. *C. difficile* infection (CDI) occurs when the disruption of good bacteria occurs after antibiotic treatment. Eradicating *C. difficile* in our health care facilities is a major problem because of its ability to produce spores that are resistant to known antibiotics and disinfectants. These highly resilient spores are the major factor for *C. difficile* transmission and recurrent infection. One way to limit the spread of the disease is to inhibit spore formation. However, the sporulation initiation pathway in *C. difficile* is poorly understood. This project proposes to understand the role of CDR20291\_0685 gene in sporulation initiation of *C. difficile*. **METHOD/RESULTS:** We observed *C. difficile* UK1 strains can switch back and forth between non-sporulating and hyper-sporulating phenotypes when grown in rich medium. We sequenced the whole genome from these two types of colonies and identified that their sequences differ only in the upstream region of CDR20291\_0685. Subsequently, we created a mutant of CDR20291\_0685 to confirm its role in sporulation. **CONCLUSION:** CDR20291\_0685 is a phosphodiesterase enzyme that degrades C-di-GMP, which is derived from GTP. Our results so far from this study suggest that *C. difficile* could switch from non-sporulating to sporulating phenotype, by sensing its intracellular GTP level.

## CELL MEMBRANE IMPRINTED NANOPARTICLE FOR ENHANCED TUMOR TARGETED DRUG DELIVERY

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**BACKGROUND AND PURPOSE:** Taking the inspiration from nature, integration of biologically derived components into synthetic nanoparticles has extended nanoparticle usage beyond its ordinary feature. The biomimetic cloaking of the nanoparticle has shown the installment of the biological complexity, thereby improving its therapeutic and diagnostic outcomes. Align towards this direction, we have developed a bio-membrane integrated nanoparticle (BIN) which could communicate immune system. **METHOD:** The proposed BIN is made up of synthetic materials integrated with cell membrane derive Natural Killer (NK) cell, a member of the immune system that can naturally seek for and destroy diseased/stress cells. The hybridization of synthetic and natural materials was achieved using extrusion technique. In vitro tumor targeting ability of BIN was investigated against normal osteoblast (NHost) and breast cancer cells (MCF-7). Further, the chemotherapeutic drug, doxorubicin was encapsulated into the core of BIN and investigated anti-tumor efficacy against MCF-7 induced solid tumor model in mice. **RESULTS/FINDINGS:** The engineered BIN shows successful translocation of cell membrane-associated proteins onto its surface. With its excellent biocompatibility, BIN shows a higher affinity towards cancer than normal cells as demonstrated by in vitro flow-passage assay and exhibits enhanced tumor homing efficiency in-vivo with an extended plasma residence time of  $18 \pm 1.5$  h. Moreover, the therapeutic potential of doxorubicin-loaded BIN shows effective antitumor activity in vivo against MCF-7 induced tumor model. **CONCLUSION:** Overall, this study demonstrated the tumor homing potential of BIN for targeted tumor therapy by exploiting the properties of the NK cell membrane, which could open a new door for design consideration in biomimetic nanomedicine

## VACCINIA VIRUS INDUCED ALTERATION OF METABOLISM AND ITS ROLE IN HOST SHUTOFF

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**BACKGROUND AND PURPOSE:** Vaccinia virus (VACV), the prototypic poxvirus, causes inhibition of host protein synthesis to hijack cellular resources for efficient virus replication. This process is known as “host shutoff.” Host shutoff can be induced by inhibition of RNA synthesis (transcription), degradation of host RNA or by upregulation of virus protein synthesis. While the mechanism of the latter two processes is better understood, how VACV inhibits host transcription is still unclear. VACV infection alters host cell metabolism that perturbs the levels of precursors required for transcription and protein synthesis. Our objective is to examine how VACV induced reprogramming of metabolism affects host transcription. **METHOD:** Global metabolic profiling and individual metabolite assays were used to measure the levels of different metabolites in VACV-infected and uninfected Human Foreskin Fibroblasts. Histones were extracted from the cells and Western blot was carried out to test the levels of proteins. **RESULTS:** We found that VACV infection drastically reduces the levels of acetyl-CoA. Acetyl-CoA is a key metabolite that donates acetyl groups required to acetylate histones, the proteins that spool the DNA to govern its constriction and relaxation. We further show that VACV infection decreases histone acetylation, which is the marker of decreased host transcription. **CONCLUSIONS:** Our findings indicate a possible mechanism that VACV by reducing acetyl-CoA level decreases the acetylation of histone to prevent host transcription and thereby, contributing to host shutoff.

## ACCIDENTAL DISCOVERY OF A HUMAN MAMMALIAN RUBULAVIRUS 5 STRAIN

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**BACKGROUND AND PURPOSE:** Mammalian rubulavirus 5, previously known as parainfluenza virus 5 (PIV5) within the *Paramyxoviridae* family, causes respiratory symptoms with unassociated disease severity in numerous mammalian hosts globally. The discovery of a divergent Russian PIV5 isolate prompted an investigation of the strain's genomic, phylogenetic, and phenotypic relations to global PIV5 strains. **METHOD:** Fecal samples from Russian piglets were processed and cultured on Vero cells. Next Generation Sequencing (NGS) occurred on the cell culture, and resulting reads underwent Kraken classification. The PIV5 genome was *de novo* assembled using A5, IVA, and Ray. PIV5 strains from GenBank were aligned using CLC Genomics Workbench version 11.0.2, and phylogenetic trees created using Geneious version 11.5.1. Protein modeling utilized SWISS MODEL, Phyre2, and Chimera. **RESULTS AND CONCLUSION:** Upon the fourth passage, Vero cells exhibited cytopathic effect, or abnormal cellular growth, attributed to human contamination from a technician ill with respiratory symptoms. Kraken identified 534,325 paired reads as *Paramyxoviridae*. The generated PIV5 genome (Moskva-16) had an 85.4% nucleotide identity to a human PIV5 strain and widened nucleotide diversity of PIV5 from 95.5-100% to 85.4-100%. Moskva-16 formed a distinct branch from previously identified PIV5 strains in a complete genome phylogenetic tree, which lacked host and geographic clustering. Relative to human strains, unique and numerous mutations, in addition to a novel truncation, were seen in surface proteins. Although, conserved regions in PIV5 saw minimal to no variation in the new strain. Moskva-16 proved PIV5 is more diverse than previously known, indicating a gap in host and geographic knowledge, while upholding previous regions of conservation.

## RELIABILITY OF POSTURAL STABILITY ASSESSMENTS WITH AFFIXED DIAGNOSTIC ULTRASOUND

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**BACKGROUND AND PURPOSE:** Affixing diagnostic ultrasound transducers to the lower limb during postural stability assessments may further elucidate dynamic musculoskeletal characteristics, which may be absent during static measurements. Although reliability of postural stability assessments have been well-established throughout the literature, it is unknown whether these measures would remain reliable with the inclusion of an attached ultrasound transducer. Evaluate the reliability of overall sway index (OSI) assessments with a diagnostic ultrasound transducer secured to the medial gastrocnemius of young healthy females. **METHODS:** Eleven females (mean  $\pm$  SD: age = 19  $\pm$  1 years) performed unilateral postural stability assessments on a commercially designed testing unit on 2 non-consecutive days at the same time ( $\pm$ 2h). Each balance assessment consisted of 3, 20-s trials on the right limb. A diagnostic ultrasound transducer was secured to the participants' posteromedial lower leg using a custom-made apparatus and co-adhesive athletic tape during postural stability assessments. Reliability of OSI was determined using intraclass correlation coefficients (ICC, model 2,1) and standard error of measurement (SEM) also reported as a percentage (SEM %). Systematic variability was examined using a one-way repeated measure analysis of variance (ANOVA). **RESULTS:** The ANOVA indicated no systematic variability ( $P > 0.05$ ). The ICC and SEM value expressed as a percentage of the mean for OSI were 0.762 and 20.91%. **CONCLUSION:** Findings demonstrate that postural stability assessments show good reliability with a diagnostic ultrasound affixed to the medial gastrocnemius of young females. The results of this investigation may improve the investigation of dynamic musculoskeletal characteristics during balance assessments.

## BIOFILM-FORMATION ABILITY OF *LISTERIA MONOCYTOGENES*

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**INTRODUCTION:** *Listeria monocytogenes* has shown niche adaptation to food processing facilities and its ability to form biofilms is a hurdle for food safety. Even if sanitation practices can minimize the risk of pathogen survival, difficult-to-clean sites in plants are still high-risk areas. The combination of sanitizers with UV light might represent an effective way to control pathogen growth. **PURPOSE:** The objective was to study the effect of sodium hypochlorite solution (SHS) and UV light alone or combined on *L. monocytogenes* biofilms survival on stainless steel (SS) surfaces. **METHODS:** A Center for Disease Control and Prevention (CDC) biofilm reactor was used to grow 4-days-old multi-strain *L. monocytogenes* biofilms on SS coupons. Different conditions were evaluated: temperature (30 and 37°C) and nutrients (Tryptic Soy Broth + 0.6% Yeast Extract and Brain Heart Infusion). SHS (100ppm for 5 and 10 min) and UV light (254nm for 15 and 30 min) were the treatment conditions applied. A control treatment was also evaluated. **RESULTS:** *L. monocytogenes* biofilm cells on SS coupons ranged from 6-7 Logs CFU/cm<sup>2</sup> for control samples. A significant reduction of 3 logs CFU/cm<sup>2</sup> was observed when surfaces were treated with SHS for 10 min as compared to controls ( $P < 0.05$ ). After UV exposure for 15 and 30 min, a 1.5 and 1.8 logs CFU/cm<sup>2</sup> was reported. A greater log reduction was observed when the SHS and UV light were combined: 4 logs CFU/cm<sup>2</sup> ( $P < 0.05$ ). **SIGNIFICANCE:** This study demonstrates the enhanced effects of SHS and UV light in combination on the survival of *L. monocytogenes* biofilms on SS surfaces.

## LEXICON DEVELOPMENT AND SENSORY ANALYSIS OF A WIDE VARIETY OF POTATOES GROWN IN THE UNITED STATES

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**BACKGROUND AND PURPOSE:** Last century has been dedicated to the development of high yielding tuber varieties with higher disease resistance. However, in coming years, breeding research will also focus on sustainability, nutrition, aroma and flavor, and “what consumers want” attributes. This research was conducted to develop a comprehensive lexicon to describe the appearance, aroma, flavor, mouthfeel, texture and aftertaste characteristics of potatoes to provide researchers, producers and manufacturers with an effective communication platform. **METHOD:** Fifty-five varieties of potatoes from Colorado and Oregon were evaluated by consensus-based descriptive analysis technique for lexicon development. **RESULTS/FINDINGS:** Fifty-five descriptors were developed and used by the panelists for differentiating among potato cultivars. By using all descriptors in the PCA plot, about half the variance among all 55 potato varieties can be explained by the first two dimensions. Russets and fingerlings had higher intensities of cauliflower and earthy aroma notes. Raw potato, musty-earthly, nutty, starchy, and cooked were the most differentiating flavor terms from a list of 21 flavor descriptors. Higher intensities of starchy and cardboard flavor were reported in chip varieties. Texture explained 73% of variance and attributes such as smoothness, particle size and mealiness were the most differentiating attributes. Fingerlings were reported to be mealier than others. **CONCLUSION:** As we are continually increasing our knowledge base, our goal should be to reach a point where growers can optimize growing, while breeders can select varieties with appropriate levels of flavor compounds, resulting in a highly desirable, nutritious food crop.



## **PASSIVE MODIFIED ATMOSPHERE PACKAGING CAN EXTEND THE SHELF LIFE AND MAINTAIN THE QUALITY OF LOCALLY PRODUCED TOMATOES.**

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**BACKGROUND AND PURPOSE:** Local fruit and vegetable production has been steadily expanding in the state of Kansas. However, locally grown produce has a shorter shelf life potential due to postharvest deterioration. Specifically, local small acreage farmers have limited access to postharvest handling resources, for example, refrigeration and many of the existing tools and techniques are not suitable for these operations. Passive modified atmosphere packaging (MAP) is a relatively inexpensive technique that has a potential for maintaining the quality and extending the shelf life of local produce, like tomatoes. Our objective was to determine the effect of passive MAP on the quality and shelf life of tomato when stored in optimum and non-optimum temperatures. **METHOD:** Pink stage BHN 589 tomatoes were packaged in passive MAP and non MAP trays and stored at 12.5 and 21°C. Their physical and nutritional quality was evaluated throughout shelf life in terms of overall visual quality, surface color, fruit firmness, electrolyte leakage, total soluble solids (TSS), antioxidant capacity and phytochemical content. **RESULTS/FINDINGS:** MAP packaging resulted in extension of shelf life for approximately 10 days at 12.5°C and 3 days at 21°C. The main limiting factor for the control treatment, at both storage temperatures, was firmness loss and decay development which was accompanied by increased electrolyte leakage. There was no difference in color development, TSS, antioxidant capacity, lycopene and total phenolic content between the two treatments. **CONCLUSION:** Passive MAP can be an effective tool for extending the shelf life and maintaining the quality of locally produced tomatoes.

## **SIGNIFICANCE OF TEMPERING METHODS ON WAXY WHITE SORGHUM MILLING AND FLOUR PROPERTIES**

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**BACKGROUND AND PURPOSE:** Sorghum is a substitute cereal for celiac and gluten sensitive people. The current sorghum milling industry is medium scale and uses hammer mills to produce whole grain flour. This results in milling losses, bran contamination, and inconsistent flour quality. Appropriate tempering methods prior to roller milling could produce white sorghum flour and also improves the milling yields and flour characteristics. **METHOD:** In this study, three sets of tempering methods were carried out: (i) cold (at 24°C for 24 h); (ii) hot (at 60°C for 12, 18, and 24 h); and (iii) steam (at 25 psi for 5, 10, and 15 s). Structural changes in sorghum kernels, single kernel characteristics (SKCS), physical properties of tempered kernels and flour quality parameters were evaluated as an effect of tempering methods. **RESULTS/FINDINGS:** The cold water tempered sorghum kernels had both lower SKCS hardness than other treatments. The densities decreased with increase in moisture content of tempered kernels due to water penetration. The millstream output at different stages of milling was used to evaluate the effectiveness of the tempering methods. Hot water treated sorghum (16% m.c for 18 h) had high flour yield due to toughening of the bran, which allowed gradual scraping of the endosperm from the bran. The damaged starch content in the milled flour was highest in the cold water treated (7.53%) sorghum, and hot water and steam treatment resulted in lower damaged starch content (7.10% to 7.16%). **CONCLUSION:** Hot water tempering could be a better pretreatment process for milling sorghum for bread making purposes.

## EMPLOYING ADAPTATION SIGNALS FROM ANCESTRAL WHEAT TO IMPROVE DROUGHT TOLERANCE IN BREAD WHEAT

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**BACKGROUND AND PURPOSE:** Breeding Wheat varieties that are better adapted to the extreme climate has become a major focus of cultivar development. *Aegilops tauschii*, “DD” genome donor, of bread wheat is a valuable reservoir of genetic diversity, of which only a small fraction has been used in improving wheat’s adaption. **METHOD:** We performed whole genome scan of 115 georeferenced *Aegilops tauschii*, and identified accessions carrying genes for adaption to extreme climate. For this we associated the patterns of genomic variation with historical climatic data from the accessions’ collection sites using multiple genotyping platforms and bioinformatics tool to analyze the data. We then developed 368 introgressed wheat lines by crossing the accessions carrying most of the adaptation genes with Kansas adapted hexaploid wheat. Currently, we are testing these novel wheat lines for drought and heat adaptive traits in irrigated and droughts condition in Colby. **RESULTS/FINDINGS:** We found genetically distinct groups of *tauschii* accessions coinciding with their geographic distribution which supports the fact that these wild relatives are rich in allelic diversity. Genomic variance partitioning and environmental association scans showed that climate plays a major role in SNP variation. We identified highly significant climate-associated SNPs that are linked with the genes known to be involved in plant growth, defense and adaptation to extreme climate. Newly developed Introgressed lines are being tested for drought and heat adaptive traits using sensors based phenotyping platforms. **CONCLUSION:** *Aegilops tauschii*, provide a great reservoir for improving existing germplasm for drought and heat tolerance.

## LIFE STAGE-SPECIFIC DIFFERENCES IN MOBILITY OF TROGODERMA VARIABLE (COLEOPTERA: DERMESTIDAE) AFTER EXPOSURE TO LONG-LASTING INSECTICIDE NETTING

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**BACKGROUND AND PURPOSE:** *Trogoderma variabile*, is a secondary pest of stored products, causing extensive damage to a variety of fragmented and finished commodities. In earlier studies, long-lasting insecticide netting (LLIN) proved to be an effective tool to control the spread of malaria by killing mosquitoes that contacted the netting. Only recently has research looked at the effects of LLIN on stored product insects, and there’s little research about how *T. variabile* is affected after exposure to netting. **METHODS:** In this study, movement and dispersal of adult and larval stages of *T. variabile* were studied after exposure to LLIN. Using video-tracking and Ethovision, distance and velocity of adults and larvae were tracked after 1, 5, and 10 min exposure to control netting or LLIN. Affected or alive insects were run after 1 min (immediate), 24, 72, or 168 h later to evaluate effects over time. For the dispersal assay, apparatuses of 10, 25, and 75 cm pipe were used with adults or larvae introduced on one side after 5-min exposure to control or LLIN. Individuals were given 48 h to disperse to a container with a novel food source after 1 min, 10 min, or 24 h. We recorded the number of insects successfully dispersing to the food source. **RESULTS/FINDINGS:** There was a significant, sustained decrease in the movement and dispersal capacity of both stages after exposure to LLIN, with adults more susceptible than larvae. **CONCLUSION:** Overall, LLIN is a promising tool for reducing the risks of infestations by stored product insects of multiple life stages.

# ECTOPIC EXPRESSION OF A *GLUTAREDOXIN* GENE IN CORN INCREASES THE TOLERANCE AGAINST DROUGHT STRESS DURING REPRODUCTIVE STAGES

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**BACKGROUND AND PURPOSE:** Drought is an important constraint to corn production, particularly during the reproductive stage, which is the most sensitive and critical for seed set and grain yield. Ectopic expression of the *Arabidopsis thaliana* glutaredoxin *S17* (*AtGRXS17*) gene in tomato resulted in plants with higher heat and drought tolerance than wild-type plants during vegetative growth. However, the effect of the ectopic expression of *AtGRXS17* during the reproductive growth under drought stress has not been studied yet. **METHOD:** Wild-type B104 and three *AtGRXS17*-expressing maize were grown in the field condition, and drought stress was imposed at tasseling (VT) and silking (R1) stages. **RESULTS AND CONCLUSION:** We report that the ectopic expression of *AtGRXS17* in maize enhanced tolerance to drought stress during reproductive stages under field conditions. *AtGRXS17*-expressing maize events displayed higher kernel set, resulting in 2-fold and 1.5-fold increase in yield in comparison to the non-transgenic counterparts when challenged with drought stress at the tasseling stage and silking stage, respectively. Our results present a robust and simple strategy for meeting rising yield demands in maize.

**FUNCTIONAL CONSEQUENCES OF GENETIC VARIATION: BIOCHEMICAL AND PHYSIOLOGICAL ADAPTATIONS TO EXTREME ENVIRONMENTS**

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**BACKGROUND:** A fundamental goal of evolutionary biology is to understand the relationship between genotype and phenotype, providing insights on the functional mechanisms underlying adaptation. Hydrogen sulfide (H<sub>2</sub>S) is a naturally occurring toxin that inhibits aerobic energy production by inhibiting the function of mitochondria. The target of H<sub>2</sub>S toxicity and the primary site of H<sub>2</sub>S detoxification both occur in the mitochondria. This relationship suggests the mitochondria likely plays an important role in adaptation to H<sub>2</sub>S. To investigate the role of mitochondria in adaptation to H<sub>2</sub>S, we conducted a set of experiments on sulfide-tolerant and -intolerant populations of *Poecilia mexicana*. **METHODS:** We measured variation in gene expression and evidence of positive selection of genes associated with mitochondrial function, used a mitochondrial-specific probe and enzymatic assays to assess if fish regulate or conform to environmental concentrations of H<sub>2</sub>S, and measured mitochondrial respiration in response to H<sub>2</sub>S exposure. **RESULTS:** There is evidence for upregulation of gene expression and positive selection on enzyme complexes associated with aerobic respiration and H<sub>2</sub>S detoxification in sulfide-tolerant populations. Sulfide-tolerant populations differ in their abilities to regulate internal H<sub>2</sub>S concentrations; however, they outperform sulfide-intolerant populations at low levels of exposure. Mitochondrial respiration is maintained in sulfide-tolerant populations regardless of H<sub>2</sub>S exposure. **CONCLUSION:** The results of this work suggest that the mitochondria of sulfide-tolerant organisms is a likely hotspot of adaptation, and the research conducted by our lab group is capable of linking functional consequences to genetic variation observed in *Poecilia mexicana*.

**EFFECTS OF DROUGHT STRESS ACROSS POPULATION AND AGE IN WILD FOXTAIL MILLET *SETARIA VIRIDIS***

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**BACKGROUND AND PURPOSE:** Drought is a major source of abiotic stress for plants, and poses an increasing threat to conservation, economic activities, and agriculture as climate change increases the stochasticity of precipitation events worldwide. Drought tolerance can vary widely between plant species, across differently adapted populations within species, and across a plant's life span. Water stress decreases photosynthesis, and can diminish vegetative growth and reproductive allocation, both of which have serious consequences for agricultural and bio-energy crops. **METHOD:** My research examines the physiological and transcriptomic responses to water limitation across populations and age in the wild foxtail millet, *Setaria viridis*, a close relative of the agriculturally important foxtail millet, *Setaria italica*. We assessed differences in drought tolerance across populations in a greenhouse drought stress experiments comparing 9 populations of *S. viridis* from locations with diverse precipitation regimes. We next compared drought tolerance in plants from 2 populations using plants of 3 different ages from each population. In both experiments, we measured pot weight, fluorescence, and photosynthetic rate to evaluate plant responses to drought stress. **RESULTS/FINDINGS** Drought response varied significantly across populations, though there was no evidence that plants from drier home ranges were more drought tolerant. Flowering time differed significantly across populations. In our second experiment, population and age both significantly affected drought tolerance, though the effect of age was likely due to plant size rather than developmental stage. **CONCLUSION:** This research will help elucidate effects of population adaptation and life stage on abiotic stress response in a close relative of an important agricultural crop.

## FINE-SCALE HETEROGENEITY IN SOIL CARBON DYNAMICS AS A RESULT OF WOODY ENCROACHMENT IN THE TALLGRASS PRAIRIE

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**BACKGROUND AND PURPOSE:** As woody plants spread through the tallgrass prairie, we expect changes in the microbial processes that remove carbon from soil. An unanswered question is whether woody encroachment of prairie will ultimately result in more carbon leaving soils than when grasses dominate. Specifically, this research aims to address how (1) microbial nutrient demand, (2) soil nutrient status, and (3) the rate of soil CO<sub>2</sub> production change with woody encroachment. **METHOD:** *Cornus drummondii* is a woody shrub that grows outward from a center point. This creates a gradient in which soils at the shrub's edge have experienced encroachment most recently while soils in the shrub's center have experienced encroachment the longest. Along this gradient, we measured the demand for and the availability of soil carbon, nitrogen, and phosphorus. We also measured soil CO<sub>2</sub> production rate and determined the proportion of CO<sub>2</sub> that was attributable to the breakdown of older grass-derived organic matter versus newer shrub-derived organic matter. **RESULTS/FINDINGS:** Carbon demand increases and nitrogen availability decreases the longer soils have experienced woody encroachment. Additionally, there was a strong correlation between CO<sub>2</sub> source and soil CO<sub>2</sub> production rate. When microbes were breaking down proportionally more woody-derived organic matter, the soil CO<sub>2</sub> production rate was higher. **CONCLUSION:** We can conclude that woody encroachment has heterogeneous effects on the soil environment that operate on finer scales than are normally measured. While we cannot determine the overall effects of woody encroachment on soil carbon balance, our results indicate that soils emit more CO<sub>2</sub> when microbes break down shrub-derived organic matter.

## METHANE OXIDATION IN NATIVE PRAIRIE SOIL

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**BACKGROUND:** methane is a potent greenhouse gas that has increased significantly since the industrial era. Native tallgrass prairie soils affect the atmospheric methane balance by consumption of atmospheric methane by methanotrophic bacteria. Previous research has demonstrated the prescribe burning increases methane oxidation. The objective of this study was to determine the effects of abiotic factors; moisture and  $\text{NH}_4^+$  on methanotrophic activity in the native prairie soil. **METHOD:** soil samples were collected from Konza Prairie Biological Station in Kansas. Homogenized soil samples were processed and incubated at ambient temperature for 48 hours at four different soil water contents (gravimetric water content-gwc 9%, 20%, 25%, 30% & 35%). Methane gas at a concentration (~3.0  $\mu\text{l/l}$ ) was added to the headspace. Selected soil samples were amended with  $\text{NH}_4\text{Cl}$  at a rate of 50  $\mu\text{g N g}^{-1}$  soil. **RESULTS/FINDINGS:** there was a significant difference in methane consumption of the soil. Methane consumption was maximum at soil 25% gwc with a rate of 0.059  $\text{nmol CH}_4 \text{ l}^{-1}\text{hr}^{-1}\text{g}^{-1}$  of soil. At lower moisture levels, methane uptake was decreased (9% gwc, 0.008  $\text{nmol CH}_4 \text{ l}^{-1}\text{hr}^{-1}\text{g}^{-1}$  of soil) due to the reduction of microbial activity and methane uptake was reduced at higher moisture levels (35% gwc, 0.009  $\text{nmol CH}_4 \text{ l}^{-1}\text{hr}^{-1}\text{g}^{-1}$  of soil) due to limited gas diffusion in the soil. **CONCLUSION:** the addition of  $\text{NH}_4^+$  inhibited methane oxidation and abiotic factors affected methane oxidation. Further, phospholipid fatty acid analysis (plfa) will be used to determine methanotroph biomass in the native prairie soil.

# LEGACIES OF HISTORIC CLIMATE SHAPE HOW TALLGRASS PRAIRIE ECOSYSTEMS RESPOND TO NOVEL PRECIPITATION REGIMES

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**BACKGROUND AND PURPOSE:** To maintain healthy prairie ecosystems and the services they provide, we must understand how climate variability shapes ecosystem processes in tallgrass prairie. Using long-term rainfall manipulations, we aim to document how and when these processes respond to altered precipitation patterns. This can aid predictions about the future of tallgrass prairie as a carbon sink and as highly productive, nutrient-rich rangelands. **METHODS:** We measured productivity and key biogeochemical processes on a long-term irrigation experiment on Konza Prairie, in which growing-season precipitation has been augmented by 33% since 1991. New treatments established in 2017– reversals of historic irrigation and additional drought treatments– allowed us to assess how climate history affects prairie responses to global change. Within these precipitation treatments, we quantified key ecosystem characteristics and processes such as plant primary production, soil respiration, stocks and production rates of inorganic N, and microbial biomass C and N. **RESULTS/FINDINGS:** Pools and processes in tallgrass prairie responded differently in time and magnitude to altered climate regimes. While microbial C stores and inorganic N supply rates changed with current precipitation, soil carbon efflux depended on both historic and current precipitation patterns. Substantial productivity responses to rainfall changes only developed after extended manipulation. **CONCLUSION:** This research provides insights into the processes most sensitive to precipitation changes in grasslands. Further work in this system will document how these ecosystem responses change through time. By studying how historic and current shape productivity and nutrient cycling, we can manage for these key processes in tallgrass prairie under future climate regimes.

## ECOTYPIC ADAPTATION OF ASCOMYCETES TO DROUGHT

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**BACKGROUND:** Precipitation varies dramatically within the central United States. There is a general understanding that communities of animals, plants, and micro-organisms differ along precipitation gradients, yet it remains uncertain whether conspecific individuals are ecotypically selected. To better understand ecotypic adaptations of ascomycete fungi to environmental conditions, we analyzed 6 conspecifics for each of 5 ascomycete species from sites that experience up to two-fold differences in mean annual precipitation (MAP). **METHOD:** We acquired fungal isolates from Sevilleta National Wildlife Refuge, 250-400mm MAP; Hays Agricultural Research Center, 450-660mm MAP; and, Konza Prairie Biological Station, ~835mm MAP. We utilized quadrant petri plates with Potato Dextrose Agar (PDA) amended with sodium chloride (NaCl) at four concentrations (0–100g/L) to test the fungal salt tolerance as a proxy for drought adaptation. Each plate (270 plates; 1,080 quadrant observations) was incubated until one isolate of a species had reached the plate edge. We then regressed the colony diameter and salt concentration to calculate the effective NaCl dose that reduced the colony diameter by 50% (ED<sub>50</sub>). **RESULTS:** In contrast to our hypothesis, individuals from arid environments did not consistently tolerate higher salt concentrations, suggesting little ecotypic adaptation among conspecifics. However, arid individuals of *Fusarium equiseti* were more salt tolerant than those from mesic environments, while *Periconia macropinosa* from arid environments were less salt tolerant than those from mesic environments. **CONCLUSION:** Further experiments will verify if NaCl concentration is a proxy for drought tolerance.

# EFFECTS OF FIRE AND HERBIVORY ON A SHRUB EXPANDING INTO TALLGRASS PRAIRIE

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**BACKGROUND AND PURPOSE:** The expansion of woody species into grasslands alters the structure and function of grasslands worldwide. This leads to decreased plant diversity and loss of forage for livestock, while removal of woody plants is both time intensive and expensive. Clonal shrubs spread laterally by vegetative reproduction and are of particular management concern because of their ability to resprout after fire and brush removal. Although fire and herbivory are known to be important drivers of grassland systems, the effects of herbivory on the growth and demographics of clonal woody species are not well understood. **METHODS:** We quantified the growth rate and demographic characteristics of the clonal shrub roughleaf dogwood in response to fire frequency, grazing, and browsing. We established transects within each shrub and stems were monitored throughout the growing season to measure mortality, natality, reproduction, and growth. **RESULTS:** Growth rates were low across all treatments in response to extreme drought during summer 2018. Browsing reduced and nearly eliminated sexual reproduction of browsed shrubs, but vegetative reproduction did not differ between treatments. Fire increased stem densities likely in response to a pulse in resource availability and reduced aboveground competition with grasses. **CONCLUSION:** Multiple pressures are needed to control shrub expansion. These results highlight the mechanisms of woody expansion in response to disturbance and may be used for the development of future management techniques to delay or reverse the process of woody encroachment.

## Interdisciplinary Research

### ESTIMATING SPATIAL INTERACTION BETWEEN SOYBEAN POTENTIAL YIELD AND BEE'S SUITABILITY USING SATELLITE DATA

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**BACKGROUND AND PURPOSE:** The balance between agriculture expansion and biodiversity conservation is a big challenge. Among the regions facing this challenge is the Brazilian Cerrado, a hotspots for biodiversity and a world breadbasket. Soybean as a main cultivated crop in this area has expanded for decades, and its yield strongly depends on the pollination provided by insects. Among these insects, bees are the most common ones with ~20% food production depending on them as pollinator. However, soybean expansion has been pointed out a threat to biodiversity. This paper sought to estimate the spatial interaction between soybean potential yield and bee's suitable occurrence. **METHOD:** in this study, we will (1) estimate soybean potential yield using satellite dataset and crop simulation model (WOFOST) for selected years (2003, 2008, and 2014); (2) develop a specie distribution model (SDM) to predict bees occurrences at 2000-2008 and 2008-2015 periods using machine learning technique. **RESULTS AND CONCLUSION:** Based on the analysis of soybean yield and bee's suitable occurrence, we concluded that changes in soybean yield was associated with bee's suitable occurrence, and during the peroid analyzed, there are indications that bees are moving to less cultivated area, which could indicated that higher soybean yield area are not suitable for bee. These findings will shed lights in the biodiversity conservation by improving our understanding how land use and land cover change is affecting biodiversity in Cerrado.

### SEEDING DEPTH AND CORN GRAIN YIELD AS INFLUENCED BY PLANTING SPEED AND DOWNFORCE SETTING ON ROW CROP PLANTERS

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**BACKGROUND AND PURPOSE:** Seeding depth is one of the key parameters which affects corn grain yield. However, maintaining a consistent seeding depth is challenging due to varying field conditions at planting. For this reason, it is important to understand planter system dynamics during actual field operation in order to implement appropriate planter settings capable of maintaining the desired seeding depth. Therefore, this study aims to evaluate the effect of ground speed and downforce setting on seeding depth and its influence on yield. **METHOD:** This study was conducted in a no-till field in 2017 and 2018 implementing two levels of downforce setting (low and high) and four levels of planting speed (4.5, 6, 7.5 and 10 mph). The planter was programmed to plant corn at a target seeding depth of 5.08 cm (2 in). Seeding depths were manually measured and corn ears were manually collected from randomly selected strips on each treatment plots. **RESULTS & CONCLUSIONS:** Results suggest that with slower planting speed, both downforce settings were able to maintain target seeding depth. Increasing speed with low downforce setting indicates insufficient load for proper soil penetration resulting to shallower seeding depth. Highest yield was achieved when seeding depth are within the target in both years.



# EVALUATION OF SATELLITE- AND MODEL-BASED SOIL MOISTURE DATA IN THE UNITED STATES

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**BACKGROUND AND PURPOSE:** Understanding spatial changes of soil moisture is essential for agriculture and water resources management. Ground-based measurements of soil moisture are spatially limited, uneven, and sparse. However, satellite- and model-based data can be reasonable alternatives required to fill the spatial gap. In this study, soil moisture estimates from NASA Soil Moisture Active Passive (SMAP) satellite and NASA Short-term Prediction Research and Transition Center-Land Information System (SPoRT-LIS) model were validated against in situ soil moisture measurements. **METHOD:** Six indicators including two correlation methods, anomaly correlation, bias, root mean square error (RMSE), and unbiased RMSE (ubRMSE) were applied to assess the agreement among data. **RESULTS/FINDINGS:** Results showed satisfying agreement between remote sensing and model-based soil moisture products and in situ measurements. In general, SMAP results were better than SPoRT-LIS. Results were influenced by seasonality and diverse ecoregions. SMAP showed its best result during winter, however, SPoRT-LIS performed better during summer. Regionally, the best performance of SMAP and SPoRT-LIS was captured over central and eastern United States. **CONCLUSION:** SMAP has been suggested as a viable product that can be applied in diverse applications such as agricultural production, water management, flood forecasting, and drought prediction.

## SEASONAL DYNAMICS OF MYCOBIOMES ASSOCIATED WITH THE BIOFUEL GRASS *PANICUM VIRGATUM*

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**BACKGROUND** Plants are not considered a single organisms, but holobionts comprised of the plant host and its associated fungal and bacterial microbiomes that critically affect the health and biomass yield of the plant. However, only limited information exists on the seasonal microbial dynamics of the microbiomes of the perennial grasses in restoration agriculture systems. *Panicum virgatum* – also known as switchgrass – is a perennial native North American C4 grass that plays an important role in conservation ecology and biofuel production. We studied switchgrass at a site assigned to conservation agriculture in Lorman, Mississippi. Our primary goals were to understand the seasonal dynamics of the switchgrass root mycobiome as well as the effects of four switchgrass varieties and two planting densities on the mycobiome composition. **METHOD** We sampled soil and roots six times during the growing season from the first leaf emergence in early spring to pre-frost in the fall. We extracted total DNA and PCR-amplified the taxon informative Internal Transcribed Spacer barcode to dissect mycobiome composition. **RESULTS** Sequencing of the barcode region will permit testing for differences between soil and root mycobiomes throughout the season as well as testing whether or not the planting densities or switchgrass varieties select for distinct mycobiomes. **CONCLUSION** Presented data will have an effect on the microbiome-informed selection of the optimal varieties or planting densities in the context of conservation agriculture.

## ACCURACY AND RESPONSE TIME OF PULSE WIDTH MODULATED AGRICULTURAL SELF-PROPELLED SPRAYER

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**BACKGROUND AND PURPOSE:** Application speeds, varying field shapes, and obstacles create a lot of control demand to large self-propelled sprayers to accurately apply the product during field operation. Large self-propelled sprayers are now commonly equipped with Pulse width modulation (PWM) liquid control system. Concerns still exist with off-rate and off-target application and inaccuracies of the controllers that potentially contribute to chemical resistance among several pest species. Hence, field experiments were conducted using a self-propelled sprayer with commercially available PWM spray control system. **METHODS:** Real-time nozzle pressures with GPS location, duty cycle, system flow rate, and ground speed were recorded using pressure transducers mounted across the spray booms. Nozzle pressure and flow uniformity (CV) across the ON boom and off-rate errors (percent difference between actual and target nozzle flowrate) were determined by obtaining the nozzle flow from nozzle pressure. **RESULTS/FINDINGS:** Nozzle CVs were less than 10% when sections were turned back ON and OFF. Entry and exit to headland causes the nozzle off-rate errors to exceed  $\pm 10\%$ . The nozzle pressure was within  $\pm 5\%$  of the target pressure for more than 93% of the time indicating droplet size consistency during application and the potential to achieve desired coverage. **CONCLUSION:** Speed variations and control system response during speed transitions affects the application uniformity of large self-propelled sprayer with PWM control system. Information about the factors affecting droplet size distribution and uniformity of application will help to improve the coverage efficiency, reduce off-rate and off target errors thus, reducing the pesticide impact to the environment.

## BIOMASS PRETREATMENT BY MAGNESIUM OXIDE FOR REDUCING SUGAR DEGRADATION AND WATER CONSUMPTION IN ETHANOL PRODUCTION

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**BACKGROUND AND PURPOSE:** Cellulosic biomass, consisting of cellulose, hemicellulose, and lignin, has great potential to be used for ethanol production. Dilute sulfuric acid pretreatment is the only one that has been industrialized for cellulosic ethanol production. However, sulfuric acid and acetic acid released from hemicellulose cause sugar degradation to furfural and 5-hydroxymethylfurfural, which will cause sugar loss. Also, formed furfural and 5-hydroxymethylfurfural inhibit downstream hydrolysis and fermentation efficiencies. To reduce the inhibitory effect, water washing and detoxification have to be conducted to remove these inhibitors, which will consume a large number of water and produce a large number of wastewater. From the above analysis, it's concluded that acid is the basic reason that causes this series of issues. Thus, seeking a chemical substance that can eliminate these issues by replacing sulfuric acid and neutralizing released acetic acid is highly desirable. **METHOD:** Metal oxides were used to replace sulfuric acid for biomass pretreatment. The pretreatment without magnesium oxide was used as control. The pH of biomass slurry after pretreatment was used to evaluate the performance of metal oxides in neutralizing released acid. **RESULTS/FINDINGS:** Magnesium oxide successfully replaced sulfuric acid and completely neutralized released acetic acid, reducing sugar degradation and inhibitor formation and increasing sugar recovery. Water washing and detoxification for inhibitor removal are no longer needed, which will largely reduce the water consumption. **CONCLUSION:** Magnesium oxide is a great chemical substance that is capable of addressing the issues caused by acids, which will benefit reducing the cost for cellulosic ethanol production.

## EXAMINING THE NARRATIVE PERSUASIVENESS OF THE 50 YEAR FARM BILL

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**BACKGROUND AND PURPOSE:** The ecology of the United States continues to be devastated by conventional agricultural systems, wherein crops are predominantly annual and grown in monocultures. The effects of such practices include hyper-industrialization, soil erosion, and pesticide/herbicide saturation. The 50-Year Farm Bill (50YFB) offers perennial, polyculture agriculture (crops not annually tilled and grown in mixtures) as an alternative model. However, most U.S. legislators are unaware of this model and its benefits. To promote awareness, its introduction lays out a narrative, and although it earned mention in *The Atlantic* and graced U.S. Senators' desks, it has not gained traction. **METHOD:** Thus, in order to understand its narrative persuasiveness, a survey analysis, utilizing a non-equivalent control group design with control (n=102) and experimental (n=81) groups, was selected for data collection. Based on the precedent of previous literature, both groups were assessed on ecological knowledge and outlook, beliefs about ecological importance, and intent to support pro-ecological policy. In addition to these baseline measures, the experimental group was given the introduction and asked the extent to which they were transported into its narrative and identified with its characters, two tenets of the Extended-Elaboration Likelihood (E-ELM) communication model. **RESULTS/FINDINGS:** 1) E-ELM significantly influenced beliefs about ecological importance, which 2) significantly influenced intent to support pro-ecological policy; and 3) experimental participants only showed a significant difference in intending to support pro-ecological policy after reading the introduction. **CONCLUSION:** Future research must address non-human character identification within agricultural policy, and differences in the types of motivation individuals have when consuming ecologically persuasive appeals.

### ***“WHO AM I AND WHAT DO I DO AS A DESIGNER?”***

#### **INTEGRATING LEADERSHIP SKILLS WITH BEGINNING DESIGN EDUCATION**

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A considerable number of beginning design students found design process overwhelming as it is different from what they had experienced in school. A certain level of independence and leadership can be very beneficial in managing how to improve and get used to the ambiguities of design process. **BACKGROUND:** Developing leadership skills by seeking people's transformation than just transferring information is introduced by Nick Petrie (2014) in his paper "*Vertical Leadership Development-Part 1: Developing Leaders for A Complex World.*" He suggests vertical leadership development which refers to "advancement in a person's thinking capability." Unlike horizontal leadership development which focuses more on "adding knowledge and skills", vertical leadership practices can help people get improved in thinking systematically and interdependently (Ibid: 6). **METHOD:** To encourage more independent thinking and self-reflection, in an action-research project called "*Who Am I and What Do I DO as a Designer?*", 14 beginning design students were given the freedom to choose what and how they went about designing. **RESULTS/FINDINGS:** Even though, students initially found it challenging to give a reasonable answer to that very question, "Who Am I and What Do I DO as a Designer?," by leveraging the leadership skills and practices and encouraging the students to spend time reflecting on "self" and the motivators that drive their work, we ended up with a classroom of first-year students who had designed something that uniquely reflected who they are as designers. **CONCLUSION:** The results of this study can help design schools with curriculum planning to help students improve technically, adaptively, and also personally.

## INTRODUCTION OF GREEK YOGURT AND ITS MARKET IMPACTS ON U.S. YOGURT INDUSTRY

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**INTRODUCTION:** Yogurt is produced and consumed worldwide, and its popularity has increased in recent years. In the U.S., the per capita consumption of yogurt has risen from 3.6 pounds per person in the year 1984 to 14.9 pounds per person in the year 2014, a 313% increase (USDA, 2016). Yogurt is high in protein and consumers often perceive it as healthier than other snacks. With the introduction of Greek yogurt by Chobani in the year 2007, Greek yogurt is the fastest growing product segment in the North America yogurt market. In this study, our key objective is to empirically examine the market impacts associated with the introduction, and rise in popularity, of Greek yogurt. **METHOD:** We estimate a structural econometric model of demand and supply, then use the estimated model to perform counterfactual experiments designed to assess the market impact that Greek yogurt has on other types of yogurt. **RESULTS:** We find that the substitutability within Greek and Non-Greek yogurt is higher relative to across these product groups. After artificially removing Greek-type yogurt from consumers' choice, our model predicts that consumer surplus declines, on average, by 31 percent. The reduction in consumer surplus in the counterfactual experiment is largely due to the increase in the price of Non-Greek yogurts in response to a removal of Greek type yogurt. These findings verify that product variety and innovation benefits consumer welfare.

## CROP DIVERSIFICATION AND SPATIAL HETEROGENEITY IN FOOD INSECURITY IN NIGER

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**BACKGROUND AND PURPOSE:** Rural areas in Niger are characterized by higher prevalence of poverty and food insecurity. Economic and spatial examination of food insecurity profile is a key step towards food security achievement. Previous researches focused on the food security status but did neither assess vulnerability scores nor the impact of crop diversity on food security. This paper examines the determinants of food insecurity, derives and maps regional vulnerability scores, and assesses the impact of crop diversification on food security for rural households in Niger. **METHOD:** Adapting the Foster-Greer-Thorbecke (FGT) poverty index to the food insecurity, the study measures the food insecurity incidence, gap, and severity. The study uses a panel data from 2,190 households, collected in 2011 and 2014 by the LSMS-ISA of World Bank. Determinants and predicted vulnerability score were estimated using OLS and Probit models, respectively. **RESULTS AND CONCLUSION:** Findings show that large households headed by less educated males, self-employed in the agricultural sector with low income, and living in Maradi, Dosso or Tillabouri regions faced the greatest food insecurity.

## **“THE FOUNDATION OF A SHORT MASS”: REVISITING THE GENESIS OF BERNSTEIN’S MISS BREVIS (1988)**

**Patrick Connor Dittamo**

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**BACKGROUND:** The preeminent twentieth-century American composer Leonard Bernstein frequently repurposed his own previously-written material to generate new compositions. His last completed choral work, the *Missa Brevis* (1988), adapted significant portions of a previous piece, his incidental music for Lillian Hellman’s 1955 Broadway play, *The Lark*. The traditional account of the *Missa Brevis*’ origin, as relayed by Bernstein’s musical assistant Jack Gottlieb, is that after attending a performance of *The Lark* the conductor Robert Shaw suggested that its incidental music could readily be turned into a *missa brevis*, and that Bernstein later revived the idea for a commission from Shaw. **METHOD:** This research reviews archival materials held by several institutions in order to form a history of the *Missa Brevis* and reassess current beliefs about its composition. **FINDINGS:** Surviving letters indicate that Bernstein was already considering using a Lark-based *missa brevis* to fulfill a Juilliard commission before the play opened on Broadway. In 1956, Shaw only expressed a desire to program *The Lark*’s music as a concert suite for an upcoming international tour. In 1983, Shaw requested a new orchestral work from Bernstein for the Atlanta Symphony Orchestra. Shaw was due to retire at the end of the 1987-88 season, and, pressed for time, Bernstein adapted *The Lark*’s music into the *Missa Brevis* as a substitute for a full orchestral piece. Bernstein attributed the idea to Shaw, but Shaw carefully avoided taking credit in a 1991 radio interview. **CONCLUSION:** The traditional narrative of the *Missa Brevis*’ origin is not borne out by the evidence

## **BLACK BUTTERFLYZ: MAKING BLACK WOMEN’S HEALTH A CAPITAL CONCERN**

**Christal Omni**

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**BACKGROUND AND PURPOSE:** Black women are disproportionately impacted by health disparities. This population is 60% more likely to be diabetic, 42% more likely to die from cancer, and 40% more likely to die from heart disease. The purpose of *Black Butterflyz* was to develop an evidenced-based, culturally-relevant intervention to increase physical activity among Black women. **METHOD:** Formative research and online surveys were conducted to identify the barriers impacting physical activity among Black women. Based on these data, a 26-week, multi-phased walking intervention was developed to provide social support while increasing participants’ levels of physical activity. Phase I of *Black Butterflyz* was conducted by the lead researcher and Phase II was conducted by trained volunteers within the *Black Butterflyz* participant pool. Participants completed pre- and post-intervention measures of physical activity, social support, and mood. **RESULTS/FINDINGS:** The *Black Butterflyz* intervention resulted in a significant increase in leisure time walking ( $p=.007$ ), moderate-intensity physical activity ( $p=.02$ ), and exercise specific social support from friends ( $p=.003$ ). Additionally, increases in leisure time physical activity were associated with increases in mood ( $p=.042$ ). **CONCLUSION:** Social support is a key factor supporting physical activity engagement among Black women. And, the *Black Butterflyz* findings identify a strong need to motivate and train Black women to engage in personal physical activity so they can lead culturally-significant group-based activities in their respective communities.

## Poster Abstracts

### Agricultural Sciences

#### **BEEDING STRATEGIES TO FIGHT A CEREAL KILLER**

Paula Silva<sup>1,2</sup>, Giovana Cruppe<sup>1</sup>, Lidia Calderon<sup>3</sup>, Byron Evers<sup>1</sup>, Barbara Valent<sup>1</sup>, and Jesse Poland<sup>1</sup>

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**BACKGROUND:** Wheat blast (WB), caused by *Magnaporthe oryzae* *Triticum* pathotype, is an emerging disease in South Asia, with the potential to devastate wheat production. WB was first reported in Brazil in 1985, however, it was not until its emergence in Bangladesh in 2016 that international attention began to focus on this disease. To date, only four major resistance genes have been identified controlling WB (*Rmg2*, *Rmg3*, *Rmg7*, and *Rmg8*). Currently, only *Rmg8* still holds potential for effectiveness under field conditions. Recently, the 2N<sup>V</sup>S fragment from the wild relative *Aegilops ventricosa* was reported to contain the only useful source of wheat head blast resistance. However, there is unclear information regarding the level of resistance conferred by 2N<sup>V</sup>S. Moreover, there is no information regarding which genes(s) on 2N<sup>V</sup>S are responsible for effectively fighting blast. **PURPOSE:** This project aims to i) characterize the WB resistance conferred by the alien fragment 2N<sup>V</sup>S and ii) search for new resistance genes in the wild relative *Ae. tauschii*. **METHODS AND EXPECTED OUTCOMES:** For the 2N<sup>V</sup>S characterization, we developed EMS populations derived from five wheat varieties showing different levels of blast resistance. These will be tested under field conditions in Bolivia in order to select for susceptible mutant plants. For the exploration of new resistance genes, we are evaluating 156 *Ae. tauschii* lines under controlled conditions. Resistant lines will be identified and, using genome sequencing data, we expect to characterize new WB resistance genes. Overall, these breeding strategies will help researchers and breeders to better understand the disease and breed germplasm resistant to WB.

#### **ANTIOXIDANT PERFORMANCES AND EMULSIFYING ACTIVITY OF CORN GLUTEN MEAL HYDROLYSATE IN OIL-IN-WATER EMULSIONS**

Yanting Shen, Ruijia Hu, and Yonghui Li

Department of Grain Science and Industry, College of Agriculture

**BACKGROUND AND PURPOSE:** Corn gluten meal (CGM) is a protein-rich co-product generated during corn wet milling. In this study, corn gluten meal was hydrolyzed using enzyme (Neutrase) for 1 and 3 hours, respectively, to obtain antioxidative protein hydrolysates (CGMH), which could be a potential antioxidant to retard lipid oxidation in various food products. **METHOD:** Our objective was to evaluate emulsion properties (e.g., emulsion turbidity, stability, particle size, microstructure, zeta-potential, and partition) and oxidation stability (e.g., POVs and TBARS) of oil-in-water emulsions containing different types (1 and 3-hour hydrolysates) and amount (0, 1, 2.5 and 5 mg/ml) of CGMH. **RESULTS/FINDINGS:** The results showed that the emulsions with CGMH had significantly improved oxidative stability than the control based on both TBARS and POV analysis. The 3-hour hydrolysate had slightly better antioxidant performances in emulsion than the 1-hour hydrolysate. The emulsion with 5 mg/ml CGMH had the most effective inhibition on lipid oxidation. The emulsion turbidity of 1-hour hydrolysate at 2.5 mg/ml had lower value than other emulsions, and overall, the turbidity for 3-hour hydrolysates had slightly higher value than that with 1-hour hydrolysate. Addition of CGMH did not affect emulsion morphology and droplet sizes. Zeta potential analysis showed that emulsions with 1-hour hydrolysate had more negative charges with better emulsion stability than that with 3-hour hydrolysate at the same pH. **CONCLUSION:** In conclusion, the CGMH was able to inhibit lipid oxidation and reduce the formation of TBARS and POVs and could be a potential functional antioxidant for food emulsion applications.

## UNDERSTANDING THE SUCCESS OF AN INVASIVE POST-HARVEST PEST OF MAIZE IN A CHANGING GLOBAL CLIMATE

Hannah Quellhorst<sup>1</sup>, Christos Athanassiou<sup>2</sup>, and W.R. Morrison III<sup>3</sup>

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**BACKGROUND AND PURPOSE:** Every year 10-30% of cereal crops, such as maize, are lost to insects after harvest. In Africa, maize is of particular importance for human consumption. The two major insect pests of maize after harvest that co-occur with each other are the invasive larger grain borer (*Prostephanus truncatus*) and native maize weevil (*Sitophilus zeamais*). Because maize is a global staple, it is important to understand 1) the optimum temperature conditions for each species alone, and 2) whether the successful competitor in mixed colonies varies with temperature, and by extension, climatic zone. **METHOD:** We evaluated single or mixed species colonies on a fixed amount of grain every 5°C between 20-35°C over a 65 d period. At the end of the period, we evaluated the damage caused by the insects to the grain. **RESULTS/FINDINGS:** We found that single species colonies of *P. truncatus* caused more severe damage to maize compared to *S. zeamais*. In mixed colonies, the damage more closely resembled that of single species *P. truncatus* colonies. Damage increased with temperature, with an advantage to *P. truncatus*. **CONCLUSION:** Overall, these results provide insight into the damage that can be caused by these two insect pests at different temperatures. As a changing climate shifts the ranges of insects, the historically tropical *P. truncatus* will likely invade new temperate regions of the world, and from our data, it is likely to be the superior competitor compared to native populations of *S. zeamais* that are already established.

## SURVEYING SPECIALTY CROP GROWERS TO ASSESS INTEGRATED PEST MANAGEMENT EXTENSION NEEDS

Chandler Day and Megan Kennelly

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**PURPOSE/METHODS:** Many fruit and vegetable producers grow a wide range of crops with a diverse range of pest problems. To understand and prioritize research and extension needs, 63 fruit and vegetable growers were surveyed at conferences to gather information about farmer backgrounds and farm systems, quantify top pest problems, current practices, and resource needs. Data was analyzed using Qualtrics, an online survey analytics tool. **RESULTS:** Nearly half (47%) of farms were less than 10 acres and 39% have operated for less than 5 years. About half (52%) of growers said they could identify diseases “usually” or “always” as opposed to “never” or “sometimes”, while 48% never use a diagnostic lab. Just over half (55%) said they can usually or always identify beneficial insects, about 2/3 (63%) can identify environmental stresses, and about 3/4 can usually or always identify insect pests (70%) and weeds (70%). Currently, 81%, 58%, and 61% frequently use online materials, printed resources, and conferences/workshops. Production systems are diverse, with 42% using a mix of organic and conventional methods. Crop rotation was listed as the most frequently used integrated pest management cultural strategy. **CONCLUSION:** Many growers are smaller-scale and new, and they seek information in diverse formats. Both organic and conventional farms’ main diagnostic challenge is disease identification, yet many growers do not use the plant disease diagnostic lab, indicating a need for further training and resources. Our results form a baseline to develop and optimize research and extension projects to better serve growers.

## DYNAMICS OF SOYBEANS AND CATTLE PRODUCTION IN BRAZIL

Rebecca Lima Albuquerque Maranhao<sup>1</sup> and Renato Fontes Guimaraes<sup>2</sup>

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**BACKGROUND AND PURPOSE:** Brazil has a privileged position in the agricultural world market notably because of its productivity gains and the incorporation of new agricultural frontiers. The expansion of agricultural frontiers has caused substantial changes in the land use and land cover in the Brazilian territory. This work aims to analyze the space-time dynamics of soybean production in Brazil from 1991 to 2015. Further, it examines the correlation between soybean crops and livestock to evaluate the substitution process between these productions. **METHOD:** Relative growth rate and acceleration of production were calculated and spatialized. The correlation between soybean and livestock was determined from the results of the acceleration of these productions. **RESULTS:** Results evidenced high growth rate and acceleration of soybean production in the South, Midwest and MATOPIBA (which aggregates Maranhão, Tocantins, Piauí and Bahia states) regions. We observed the production flow of soybean and the cattle production to the north and northwest direction, respectively. Municipalities with an inverse correlation production are prominent in the states of Rio Grande do Sul, Paraná, São Paulo, Mato Grosso do Sul, Mato Grosso, Goiás, eastern Minas Gerais, Matopiba, Pará, and Rondônia. **CONCLUSION:** This perspective shows that the displacement of cattle production to North has been accompanied by the expansion of soybean production in the Midwest and Northeast. Governmental actions are essential to identify the spatiotemporal dynamics of agricultural production which has been a driver for accelerated change in land use especially in the Amazon Frontier.

## SOIL HEALTH OF LONGTERM WHEAT AND SOYBEAN ROTATIONS

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**BACKGROUND AND PURPOSE:** Soil health is a goal of agricultural systems that refers to the integration of physical, chemical and biological soil properties that supports agricultural production and ecosystem services. Soil health is important for sustainable climate resilient agriculture. No-tillage and crop rotations are important for maintaining soil health. No tillage is performed to maintain soil moisture, control erosion, sequester organic carbon, and preserve soil fertility. Intensive cultivation is known to disrupt soil aggregates, reduce water infiltration, increase erodibility, and reduce soil organic matter. **METHOD:** This study was conducted on long term (>40 year) continuous wheat-wheat and wheat-soybean rotations at depths of 0-5 and 5-15 cm with three different tillage systems, no-tillage, minimum tillage and intensive tillage. Soil samples were analyzed to explore the change in soil moisture content, soil pH, plant available nutrients, soil macroaggregates, soil inorganic nitrogen, and soil microbial diversity as indicators of soil health. **RESULTS/FINDINGS:** The soil water content was highest in no-tillage followed by conventional tillage and then by minimal tillage. Soil phosphorus was greatest in the wheat-wheat plots of both 0-5 cm and 5-15 cm horizons. Greater aggregation was shown in wheat-wheat crop rotation than wheat-soybean due to greater subsoil root development and more carbon sequestered into the soil. No-till treatments had greater macroaggregates due to less disturbance and greater soil organic matter. **CONCLUSION:** By analyzing how different tillage systems and crop rotations affect soil quality, farmers can produce greater soil organic carbon, better soil structure, higher microbial diversity, greater crop yields, and greater disease resistance.



## **SENSORY AND VISUAL EVALUATION OF SIX DIFFERENT BEEF SHANK CUTS FROM ASIAN CONSUMERS**

**Wanjun Wu**, Emily A. Rice, Brittany A. Olson, Lauren L. Prill, Travis G. O'Quinn, and Michael D. Chao  
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**BACKGROUND AND PURPOSE:** A significant percentage of beef shanks produced in the U.S. is sold through domestic Asian markets or exported to Asian countries as whole-muscle cuts. However, there is no detailed study that characterizes different beef shank cuts based on Asian consumer preferences. The objective of this study was to evaluate factors affecting Asian consumers' purchasing decisions and eating preferences of six different beef shank cuts. **METHOD:** Six different beef shank cuts, three from forequarter [biceps brachii (shank A); a combination of deep digital flexor and flexor digitorum superficialis (shank B); extensor carpi radialis (shank C)], and three from hindquarter [deep digital flexor (shank D); flexor digitorum superficialis (shank E); a combination of long digital extensor, medial digital extensor and peroneus tertius (shank F)] were collected from 12 USDA low choice beef carcasses. Shanks from the left side were used for Asian consumer taste panels, while shanks from the right sides were used for visual evaluation. **RESULTS/FINDINGS:** Shanks A, E, and F all received high sensory scores, followed by shanks C and D, with shank B received the lowest score among all the shank cuts ( $P < 0.05$ ). In addition, consumers indicated that shanks A and C were most visually acceptable, while shanks B, D, E, and F were less acceptable compared to shanks A and C ( $P < 0.05$ ). **CONCLUSION:** The results indicated that connective tissue texture and amount directly affect Asian consumers' eating preference of different beef shank cuts, while shank size is the main factor affecting their purchasing decision.

## INVESTIGATION OF THE PREVALENCE OF SALMONELLA SPP IN UNITED STATES FEED MILLS

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**BACKGROUND AND PURPOSE:** *Salmonella* has been detected in animal feeds and pork products, raising questions on the role of feed and feed mill environments in introducing contamination into the feed-to-fork chain. Pathogens occurrence patterns and related risk factors might help design microbial risk assessment and control strategies. The purpose was to determine the prevalence of *Salmonella* and *E. coli* at different sites within mills and identify potential risk factors associated with their prevalence in feed processing facilities. **METHOD:** Twelve sites were targeted within each of the six mills in the Midwestern region during fall 2018. Samples were analyzed for the presence of both *Salmonella* and *E. coli* with culture methods, followed by PCR confirmation. A survey regarding production volumes, hygiene practices, and microbial testing was conducted in each facility. **RESULTS/FINDINGS:** From the total of 135 samples obtained, 8.2% (11) contained *Salmonella* spp. and 23.0% (31) contained *E. coli*. All sampled mills had at least one site containing *Salmonella* spp. or *E. coli*, six sites contained both. Floors had the highest number of confirmed samples, suggesting that foot traffic may be a biosecurity risk. Survey responses support that mills with higher bacteria loads are older, suggesting that age of the mill may be a risk factor for pathogen contamination. In addition, it was noted that not all mills have microbiological testing on site. **CONCLUSION:** The data documents a relatively high prevalence of *E. coli* and *Salmonella* in U.S. swine feed mills. This information could be used to evaluate risks and design mitigation strategies.

## FERRIC PYROPHOSPHATE IN EXTRUDED, FORTIFIED RICE LEADS TO BETTER IRON OUTCOMES THAN FERRIC PHOSPHATE IN RATS

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**BACKGROUND:** Rice fortification is a promising approach to reduce micronutrient deficiencies. Ferric phosphate (FePO<sub>4</sub>) and ferric pyrophosphate (FePP) iron forms have better sensory properties than other iron forms. Micronized FePP or addition of citric acid (CA) and trisodium citrate (TSC) to FePP (FePP+CA+TSC) have been suggested to increase bioavailability. Our objective was to compare iron bioavailability of extruded rice with these iron fortificants. **METHODS:** Rice flour was fortified with a vitamin/mineral blend and one of the iron fortificants: FePO<sub>4</sub>, FePP, micronized FePP, or FePP+CA+TSC, and extruded into kernels. Extruded rice was combined with white rice (1:100), soy protein isolate, and soybean oil to meet rat nutritional requirements. Five groups of weanling, male Sprague Dawley rats (n=10) were randomly assigned to consume one rice diet or AIN-93G control diet. Food intake was measured daily and body weights were taken weekly. Because of poor growth in the rice groups, the study was terminated after 21 days and blood and livers were collected. **RESULTS:** All rice groups had significantly lower moisture-adjusted total food intake, weight gain, and final weight compared to AIN-93G group with no differences between rice groups. Hemoglobin levels were significantly higher in FePP and micronized FePP groups compared to FePO<sub>4</sub> and AIN-93G groups. Hepatic iron levels were significantly higher in FePP, micronized FePP, and FePP+CA+TSC groups compared to FePO<sub>4</sub> and AIN-93G groups. **CONCLUSION:** While they need to be interpreted with some caution, our results suggest that FePO<sub>4</sub> leads to poorer iron outcomes than FePP, but neither micronizing nor adding CA+TSC to FePP improves iron outcomes.

## REGULATION OF LEUCINE BIOSYNTHESIS AND A KEY NITROGEN ASSIMILATION GENE BY THE TRANSCRIPTION FACTOR LEUR IN *ASPERGILLUS NIDULANS*

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**BACKGROUND:** Branched chain amino acids (BCAAs) leucine, isoleucine, and valine are essential amino acids, unable to be synthesized by animals and must be obtained through their diet. Many fungal species, including *Aspergillus*, *Candida*, and *Saccharomyces*, synthesize BCAAs. Proper regulation of BCAA metabolism is important for protein synthesis, growth, and virulence. In *Aspergillus nidulans*, the transcription factor LeuB regulates leucine biosynthesis in response to leucine levels. LeuB also regulates expression of *gdhA*, which encodes the key nitrogen assimilation enzyme. We have identified a paralog of LeuB, LeuR, and examined its role in leucine biosynthesis and *gdhA* regulation. The *leuB* $\Delta$  mutant is a leaky leucine auxotroph. We deleted *leuR* and found the *leuR* $\Delta$  mutant to be a prototroph. However, the *leuB* $\Delta$  *leuR* $\Delta$  double mutant is a tight leucine auxotroph, indicating a role for LeuR in regulating leucine biosynthesis. **METHODS:** Using a *gdhA-lacZ* translational fusion reporter gene and exogenous leucine, we have shown that LeuR regulates *gdhA* expression. We now are using a series of deletions in the *gdhA* promoter to compare the wildtype strain to *leuB* $\Delta$ , *leuR* $\Delta$ , and *leuB* $\Delta$  *leuR* $\Delta$  mutants to identify where LeuR acts in the *gdhA* promoter. **RESULTS:** Our experiments show that the transcription factors LeuB and LeuR link regulation of nitrogen assimilation and leucine biosynthesis. **CONCLUSION:** These findings will identify a site of action in the *gdhA* promoter by LeuR. A better understanding of the metabolism and regulation of BCAA synthesis in *Aspergillus nidulans* could provide new anti-fungal targets in human and crop pathogens.

## PREVALENCE OF *SALMONELLA SPP.* ISOLATED FROM ENVIRONMENTAL FOOD SURFACES FROM VEGETABLE MARKETS IN CAMBODIA.

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**INTRODUCTION:** Informal vegetable markets are an important part of the culture and economy in Cambodia. However, their lack of hygiene and sanitation practices, food safety regulations, and infrastructure present a risk of contamination to the vegetables and those who consume them. **PURPOSE:** To determine the prevalence of *Salmonella spp.* in informal vegetable markets in Cambodia. The effect of location within the market (inside and outside) and surface types (food contact surface, FCS and non-food contact surface, NFCS) was evaluated. **METHODS:** Surface types (FCS and NFCS) were collected following the Food Safety and Inspection Service (FSIS) Directive 10,300.1 and analyzed for *Salmonella spp.* by using FSIS Microbiology Laboratory Guidebook. Data was collected in a nested design and analyzed using a generalized linear mixed-model ANOVA. Significant effects means were compared at  $\alpha = 0.05$ . Relative risk was calculated. **RESULTS:** Preliminary data indicated an overall *Salmonella spp.* prevalence of 50%. There was no significant effect of location (p-value=0.90). A significant effect of surface type was observed (p-value=0.01) with a prevalence of 66% and 36% for FCS and NFCS, respectively. Vegetables exposed to FCS were 27% more likely to be exposed to *Salmonella spp.* when compared to NFCS. **SIGNIFICANCE:** To the best of our knowledge, this is the first study to investigate the prevalence of *Salmonella spp.* in environmental samples from informal vegetable markets in Cambodia. The availability of accurate data on the prevalence of *Salmonella spp.* in these markets is crucial for effective surveillance, implementation of suitable intervention strategies and prevention of future foodborne illness cases in Cambodia.

## ANTICANCER DRUG LOADED HYBRID-EXOSOME FOR TUMOR TARGETED DRUG DELIVERY

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**BACKGROUND AND PURPOSE:** Extracellular vesicles (EVs) are vesicles secreted by cell for cellular communication. They are made up of phospholipid bilayer with characteristic protein content and can be found in wide range of size (30 nm-micron). Among these EVs, the smaller size (30-200nm) is normally called as exosomes. Small EVs (sEVs) have now been explored as a potential candidate in therapeutics delivery owing to their intrinsic targeting property and ability to cooperate with host defense system. Considering these potentials, we hypothesize that immune cell-derived sEVs can mimic immune cell to target cancer. However, different sEVs isolation technique reported poor yield and loss of functional properties. **METHOD:** To solve this problem, herein we hybridized sEVs with synthetic liposome to engineer vesicles (size<200nm) to mimic the size of exosome, and named as hybrid exosome (HE). To achieve this goal, exosomes derived from mouse macrophage J774A.1 were hybridized with a synthetic liposome using membrane fusion. Fluorescent-based experiment and blot-techniques were carried out for characterization. Furthermore, Doxorubicin, a model anticancer drug, was loaded in the aqueous core of HE using physical encapsulation strategy to formulate HE-DOX. Selective cytotoxicity of HE-DOX was studied in-vitro against cancer cells and normal cells. **RESULT AND CONCLUSION:** A differential cellular interaction of HE was observed when treated with normal and cancerous cells thereby supporting our hypothesis. HE-DOX showed enhanced toxicity against cancer cells and pH sensitive drug release in acidic condition, benefiting drug delivery to acidic cancer environment. These results suggest that the engineered HE would be an exciting platform for tumor-targeted drug delivery.

## OVEREXPRESSION OF THE PROTEASOME ACTIVATOR, BLM10, AFFECTS THE PROTEASOME LANDSCAPE

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**BACKGROUND AND PURPOSE:** The proteasome is a large protein complex that is responsible for degrading misfolded, damaged, and unneeded proteins. As such, it plays an important role in preventing the accumulation of these proteins within our cells, which reduces the chance of developing certain diseases. The formation of proteasomes involves an intricate assembly process where 66 subunits come together to form a complex structure. During this process, two major subcomplexes, the regulatory particle (RP) and the core particle (CP), form and then interact to produce a degradation competent complex. Surprisingly, there is a protein that competes with RP for binding to CP and thus reduces the number of functional proteasomes formed. This competitor, Blm10, is found in yeast and mammalian cells and its function remains largely unknown. The goal of my research is to gain insight into the function of Blm10 and understand the cellular ramifications when Blm10 outcompetes RP. **METHOD:** We manipulated the levels of Blm10 in the cell by introducing promoters of different strength at the endogenous locus of Blm10. We also introduced various fluorescent tags to monitor the proteasome complexes *in vivo* and *in vitro*. This allowed us to understand the competition between Blm10 and RP for CP binding by using native gel electrophoresis. **RESULTS AND CONCLUSION:** Overall, we found that overexpression of Blm10 resulted in a dramatic increase in (Blm10)<sub>2</sub>-CP complexes with hardly any RP-CP complexes remaining. This resulted in a mild cell survival phenotype showing that prevention of RP/CP interaction is detrimental.

# DETECTION, ISOLATION, CHARACTERIZATION and ANTIMICROBIAL TESTING OF SUSCEPTIBILITY OF *SALMONELLA ENTERICA* FROM WHEAT GRAIN SAMPLES

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**BACKGROUND:** *Salmonella* is a Gram-negative, motile bacteria that is capable of causing disease in cold-blooded and warm-blooded animals. This bacterium is a major foodborne pathogen that cause about 1.2 million (a million are food related) reported cases of salmonellosis each year. *Salmonella* has the ability to survive in the environment possibly infecting natural plant life and food crops. **PURPOSE:** To detect and isolate *Salmonella* from wheat grains that were harvested, transported and stored from different regions of the country. **METHOD:** A total of 625 wheat grain samples, transported to the laboratory, were stored at -80°C until analyzed. Over a thirteen-week period, 50 samples per week were randomly selected and thawed at 4°C. Two enrichment methods were used for detection and isolation of *Salmonella*. The first method consisted of 25 g of sample suspended in 225 ml of modified buffered peptone water with pyruvate (mBPW) for 24 hours and then RV broth for 24 hours. In the second method 25 g of sample suspended in 225 ml of RV broth and then incubated for 48 hrs. DNA was extracted from the enriched samples and analyzed by PCR for *invA* and *pagC* genes. PCR-positive samples were then plated on Hektoen-Enteric agar. Putative colonies were confirmed as *Salmonella* by agglutination test with polyvalent sera and PCR for *invA*. **Results/Conclusion:** Eight samples (1.3%) were positive for *Salmonella*. This study showed that harvested wheat grains carry *Salmonella* and further investigation is needed to determine the source of contamination and its pathogenic potential.

~WITHDREW~

## GLYCEMIC RESPONSE TO TWO DOSES OF RESISTANT STARCH TYPE 4: A RANDOMIZED CONTROLLED CROSSOVER TRIAL

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**BACKGROUND:** Resistant starches (RS) have beneficial metabolic effects following carbohydrate (CHO) consumption. The purpose of this study was to determine whether the glycemic response to an RS4 bar was different compared to a puffed wheat bar (PWB), provided at 50g and 30g available CHO amounts. **METHODS:** Apparently healthy adults ( $n=15$ ;  $26.1\pm 4.8$  yrs) participated in this controlled randomized-crossover trial. All participants completed six trials: 50g and 30g dextrose control drinks (50DEX/30DEX); and nutrition bars containing: 50g and 30g available CHO as PWB or RS4 (50PWB/50RS4/30PWB/30RS4). Participants fasted for 10–12hrs before each visit with a minimum 72hr washout period between visits. Blood glucose was measured via Cholestech LDX<sup>®</sup> at baseline and 10, 20, 30, 60, 90, and 120min post consumption. **RESULTS:** Glucose incremental area under the curve (iAUC) was not significantly different between 50g conditions ( $p=0.054$ ). Peak blood glucose was significantly lower for 50RS4 compared to 50PWB and 50CON ( $p=0.027$ ;  $p=0.004$  respectively), with no difference between 50PWB and 50CON ( $p=0.496$ ). The 30RS4 and 30PWB glucose iAUCs were lower compared to 30CON ( $p=0.002$ ), with no difference between 30RS4 and 30PWB ( $p=0.48$ ). Peak blood glucose was reduced for 30PWB and 30RS4 when compared to 30CON ( $p=0.005$ ;  $p=0.002$  respectively), with no difference between 30g CHO bars ( $p=0.22$ ). **CONCLUSIONS:** Results indicate a potential dose-response for RS4 on postprandial glycemia. With 50g of available CHO, RS4 reduced peak blood glucose as compared to PWB. Future research should investigate insulin response and a possible floor effect for RS4 on glycemia given the lack of glycemic lowering at the 30g available CHO amount.

## PREVALENCE AND QUANTIFICATION OF *SALMONELLA* SPP., *E. COLI* AND COLIFORMS ON VEGETABLES SOLD IN INFORMAL MARKETS IN CAMBODIA

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**BACKGROUND:** Vegetables in Cambodia are commonly sold in informal markets that escape food safety standards and controls. Consumption of contaminated raw vegetables can potentially cause foodborne illness, however, a full investigation of biological contamination of vegetables in Cambodian informal markets has yet to be conducted. **PURPOSE:** To investigate the prevalence and concentration of *Salmonella* spp., and the concentration of generic *Escherichia coli* and coliforms, on fresh vegetables sold in informal markets in Cambodia. **METHOD:** A total of  $n=52$  lettuce,  $n=52$  tomatoes and  $n=52$  cucumber samples were collected from informal markets. *Salmonella* spp. qualitative data collection methods included samples incubation in both a pre-enrichment and selective enrichment broth, followed by isolating on Xylose Lysine Tergitol-4 (XLT-4) and Brilliant Green Sulfa agar. Quantitative data was collected by plating onto Enterobacteriaceae (EB) and *E. coli*/Coliforms (EC) petrifilm. A transfer plating method of EB petrifilms was used to quantify *Salmonella* spp. Agglutination was used to identify presumptive positives. **RESULTS:** Overall prevalence of *Salmonella* spp. on vegetables purchased from informal markets was 18.6% (lettuce=15.4%, tomatoes=19.2%, and cucumber=21.2%). Lettuce had a significantly higher count of *Salmonella* spp., generic *E. coli* and coliforms (6.3, 2.4, 6.3 log CFU/g), as compared to tomatoes (5.0, 0.8, 5.3 log CFU/g) and cucumbers (4.9, 0.9, 4.3 log CFU/g). **CONCLUSION:** To our knowledge, this is the first study that explores the biological contamination of fresh vegetables sold in Cambodian informal markets. Preliminary data shows that the vegetables sold are contaminated with biological hazards, and that interventions are necessary to reduce the likelihood of negative public health outcomes.

## ROLE OF GYMNEMIC ACIDS IN *CANDIDA ALBICANS* MORPHOGENESIS AND VIRULENCE

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**BACKGROUND AND PURPOSE:** The opportunistic human fungal pathogen *Candida albicans* is characterized by its ability to switch from yeast to hyphae, a process critical for virulence. *UME6* and *NRG1* are major transcription factors that regulate *C. albicans* hyphal growth positively and negatively, respectively. Gymnemic acids (GAs), a medicinal plant-derived nontoxic compound, inhibited the yeast to hypha conversion and hyphal growth in *C. albicans*. We hypothesize that GAs affect the activities of these regulators by modulating the interactions of cognate partner proteins with Ume6p and Nrg1p, and that could disrupt the processes required for yeast to hypha conversion and hyphal growth. **METHODS:** To identify the interacting proteins of Nrg1 and Ume6, both control and treated soluble cellular proteins were tandem affinity purified and analyzed by mass spectrometry. Some of the results were validated by gene expression and biochemical studies. **RESULTS AND CONCLUSION:** Genetic studies confirmed that GAs act through these transcriptional regulators, in addition to other mechanisms. Mass spectrometry analyses identified over 200 proteins that include proteins with DNA, RNA binding, oxidoreductase and structural activities that are significantly higher in GAs treated samples. Reporter fusion assays of Nrg1 and Ume6 confirmed their upregulation and downregulation in GAs treated samples, respectively. Further analysis on how GAs affect interaction of proteins with these two transcription factors could elucidate the molecular mechanism of hyphal growth inhibition in *C. albicans* and may help develop novel antifungal therapeutic strategies.

## THEORETICAL STUDY OF NONADIABATIC RELAXATION DYNAMICS

IN  $[\text{Au}_{25}(\text{SeCH}_3)_{18}]^-$  AND  $[\text{Au}_{13}(\text{P}_2\text{H}_4\text{C}_2\text{H}_4)_5\text{Cl}_2]^{3+}$

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**BACKGROUND AND PURPOSE:** Once the light bombards any substance, electrons in the substance get excited to different upper energy levels. Electron relaxation dynamics to understand the time taken by excited state populations to decay back to ground state are very useful to determine whether the nanoclusters are suitable candidates as sensitizers of solar cells. In this work,  $\text{Au}_{25}(\text{SeCH}_3)_{18}^-$ , which is thought to be more stable than its thiolate-stabilized counterpart, and  $[\text{Au}_{13}(\text{P}_2\text{H}_4\text{C}_2\text{H}_4)_5\text{Cl}_2]^{3+}$ , which has not received much attention from researchers despite being easy to synthesize on a large scale, have been studied theoretically. **METHOD:** Time dependent density functional theory (TDDFT) calculations are performed to study the core and higher excited states up energies of 2.5 eV and 3.5 eV in the selenolate and diphosphine-stabilized systems, respectively. The dynamics of the systems are studied using a surface hopping approach. **RESULTS:** Six states with excitations ranging from HOMO-2 to LUMO+1 based in the core of the selenolate-stabilized cluster contribute while 25 states from HOMO-4 to LUMO+4 contribute to the core of diphosphine-stabilized system. Electron relaxation among excited states occurs in the range of 2.7 ps to 10.5 ps in the selenolate-stabilized system while the time to repopulate the ground state ranges from 52.8 ps to 117.1 ps. Similarly, decay time constants for the diphosphine-stabilized system lie in the range of 0.5 ps to 20.3 ps and ground state growth times range from 81.6 ps to 375.5 ps. **CONCLUSION:** Slower ground state growth times makes the diphosphine-stabilized systems better to act as sensitizers of solar cells.

## ENHANCING ACETYL-TAG SYNTHESIS THROUGH METABOLIC ENGINEERING OF THE OILSEED CROP *CAMELINA SATIVA*

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**BACKGROUND AND PURPOSE:** The high viscosity and melting point of vegetable oil, mainly consisting of regular triacylglycerols (TAG), prevent its direct use as biofuel for diesel engines. Acetyl-TAGs, which possess an sn-3 acetate group, however bypass such drawbacks due to reduced viscosity and superior cold temperature properties. Acetyl-TAG was previously engineered in *Camelina sativa* by the seed specific expression of *Euonymus alatus* diacylglycerol acetyltransferase (*EaDacT*). To further increase acetyl-TAG accumulation in transgenic camelina seeds, multiple strategies were examined in this study. **METHODS:** A new acetyltransferase enzyme (*EfDacT*) isolated from the seeds of *Euonymus fortunei*, shown to possess higher *in vitro* activity and *in vivo* acetyl-TAG levels compared to *EaDacT*, is expressed in camelina seeds. *EfDacT* expression is combined with the RNAi-mediated suppression of the endogenous TAG competing enzyme (DGAT1). Agronomic properties of the seeds were analyzed to examine the effect of accumulating high levels of acetyl-TAG. **RESULTS/FINDINGS:** *EfDacT* expression increased acetyl-TAG accumulation by 20 mol%. Suppression of DGAT1 further enhanced acetyl-TAG accumulation to 90 mol% in selected transgenic lines. Accumulation of high levels of acetyl-TAG demonstrated little or no impact on seed size, weight, and fatty acid content. High acetyl-TAG containing seed exhibited a two-day delay in germination compared to wild-type seed. Quantification of *EfDacT* protein levels in developing seed revealed that in high acetyl-TAG producing lines, *EfDacT* protein expression is not limiting acetyl-TAG accumulation. **CONCLUSION:** Our results show that acetyl-TAG successfully accumulates to levels beyond those reported with any modified oil content in an engineered oilseed crop, with only minor impacts on key seed properties.

## PERFORMANCE ANALYSIS AND OPTIMIZATION OF MICRO-FIN CONFIGURATION IN A TUBE

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**BACKGROUND AND PURPOSE:** The conventional method of increasing heat transfer rate between a solid surfaces and its environment is the use of extended surfaces or fins. One area of special importance is small fins placed on heat exchange surfaces often termed “micro-fin”. These fins change the local surface area, local fluid flow patterns, and local heat transfer coefficient in a complex manner leading to changes in thermal and hydraulic performance. Studies of the flow fields around these fins have appeared in literature but often do not include the conduction analysis in the fin leaving a key optimization parameter unexplored. This focus of this study is to fill this gap by investigating the influence of micro-fin design parameters such as micro-fin geometry, height, angle to the flow direction, and pitch on performance criteria. Physical insight into the design space is gained by holding the micro-fin volume constant over the simulation space. **METHOD:** A coupled numerical simulation of the flow and solid domains with periodic boundaries were setup in ANSYS Fluent and the performance was mapped. A total of 49 cases (one smooth tube and 48 micro-finned tubes) were considered in which turbulent flow was dominant and Reynolds number was about 15000. **RESULTS and CONCLUSION:** Results showed that a transverse rectangular fin to flow direction with lowest fin height has the best design. This study can be a great guideline for riblet configuration analysis concerning drag reduction performances as well.

## CORRELATING PLASMON DYNAMICS WITH NUCLEAR VIBRATION

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**BACKGROUND AND PURPOSE:** When some compounds are irradiated with light, they emit characteristic colors in the visible region due to the oscillation of conducting electrons known as plasmon resonance. Plasmon resonance of noble metal nanoparticles as well as nonmetallic substances such as carbon nanotubes and graphene is used in a variety of applications including bioimaging, catalysis and energy harvesting. The frequency and strength of oscillation is highly dependent on the structure of the compound at atomic level, and thus can be tuned over the UV-vis region. However, slow decay of the plasmon is beneficial for the applications, and therefore the processes resulting in this decay have been a matter of interest in both the experimental and theoretical research community. Nuclear motion is one of the processes which is thought to be responsible for the dissipation of plasmons. The purpose of this study is to correlate the plasmon decay of small molecules with their vibrational motion. **METHOD:** In this work, first principle molecular dynamics simulations on naphthalene molecule are carried out in order to explore the effect of vibrational motion on plasmon decay. We selectively activate one normal mode at a time and observe the dynamics of the plasmon that arise as a response to a step field perturbation. **RESULTS AND CONCLUSION:** We try to identify a relationship between the vibrational modes and the plasmon decay based on symmetry consideration. This will lead to new postulates on the reasons behind the effect of particular nuclear motions on the decay of plasmons, allowing experimentalists to improve real world applications.



## THE HIDDEN WATER AND ENERGY DEPENDENCY OF OUR DIGITAL SOCIETY

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**BACKGROUND AND PURPOSE:** Water and energy are strongly interlinked, such that the utilization of one resource implicitly requires use of the other. Data centers comprised of computer systems and related components represent one of the largest and fastest growing energy users in the United States, responsible for almost 2% of the nation's overall electricity usage. The growing energy requirements of this industry has been of great interest for both researchers and policymakers. However, very little attention has been given to the water footprint of these data centers, which is tightly coupled with its energy consumption. Here, we provide a spatially-detailed mapping of water and energy use by data centers and the related environmental implications. **METHOD:** Water used directly by data centers is calculated based on the cooling system of the facility that dissipates the tremendous amount of excess heat released by the computer components. Indirect water use of data centers is calculated by distributing their electricity consumption among nearby power plants and then calculating the associated water consumption for the given power plant. We tested the sensitivity of our results to different methods for linking energy production and consumption found within the literature. **RESULTS/FINDINGS:** Our results demonstrate that an incidental and avoidable impact of the growing number of data centers is the large water use within water stressed basins. **CONCLUSION:** We conclude by recommending wider implementation of existing cooling and energy production technologies that reduce water use, as well as greater consideration to wider environmental concerns when placing future data centers.

**HEALTH MESSAGE PERSONALIZATION AFFECTING COFFEE BEVERAGE CONSUMPTION**

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**BACKGROUND/PURPOSE:** Since the 1990s, consumption of what our lab has coined "specialty coffee drinks" like mochas and frappuchinos have continued to rise. Despite having similar amounts of caffeine between traditional brewed coffee and these specialty drinks, the latter cost nearly double and contain around 10x as many calories as the former. Consumers may not always be cognizant of these differences; thus, the use of persuasive health messages to inform consumers of these differences is necessary. "Feedback-related" persuasive health messages have been shown to be successful in supporting compliance to healthy dietary behaviors and reducing binge-drinking, but it has not yet been investigated in this context. **METHOD:** 102 participants completed an online survey about their coffee consumption behaviors that also included a feedback-related health message intervention, based on the participant's random condition assignment. **RESULTS:** Contrast tests following a Poisson regression revealed that individuals who read either of the two feedback-related messages intended to consume fewer specialty coffee drinks in the future than those who did not read a message. There was no difference in consumption intention between participants who read the generic-feedback and personalized-feedback messages. **CONCLUSION:** Although there was no significant difference between the two feedback-related messages, their effect on behavior intention over no message is promising. Future investigation into this relationship is promising, including exploring various individual difference factors and applying modifications to the generic-feedback messages being used. A number of implications regarding advertising and health research are discussed.

**A PATTERN LANGUAGE FOR INCLUSIVE DESIGN IN PRIMARY EDUCATION**

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**BACKGROUND AND PURPOSE:** In 2014, the National Center for Educational Statistics found that most of the disabled students in America attended public school and not a specialized school for disabilities. Despite the number of children with limitations attending public school, some architects/designers assume that the solution lies in specialized schools. However, integrating students with differing abilities not only helps these students academically, but also helps these students to build the social skills they need to succeed as adults. Through careful planning and preparation, a public school can be designed for a quality inclusive education. **METHOD:** Due to the lack of existing pattern languages for inclusive design in schools, new ones are derived from existing examples. The pattern languages derived in this study are drawn from existing specialized schools. Only four types of differing abilities are investigated for this research. For each category, we consider one or two schools that were designed specifically with those unique needs in mind. From those examples, we then derive design strategies to create a pattern language. This research will look at visual, ambulatory, and hearing limitations as well as autism. **RESULTS/FINDINGS:** After comparing all the design strategies derived from researching the four differing abilities, many similarities were found among them. Although many of the patterns found in this study worked under several categories, more extensive research should still be done on the numerous other limitations found in public schools. Many of the pattern languages found in this research benefit all users, not just those with differing abilities.

## ADVENTURE TO THE GREAT UNKNOWN: EXPLORING THE SEMANTIC CREDIBILITY OF UNNAMED AND ANONYMOUS SOURCES

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**BACKGROUND AND PURPOSE:** Anonymous sourcing in journalism has been debated since its inception in yellow journalism. Misuse of anonymity in cases of journalistic deviancy has led to a heated public condemnation of anonymous sourcing. Nonetheless, anonymous sources have also proven to be a necessity in sustaining the watchdog responsibilities of the press. This study examined an unexplored linguistic phenomenon to aid in anonymity's integrity; the credibility and believability of the phrases 'unnamed source' v. 'anonymous source,' and how linguistic choices can bolster news story and source credibility: **RQ1.** *How does using anonymous sources and unnamed sources affect the overall credibility of a news article?* **RQ2.** *How does using the phrase anonymous source v. unnamed source affect the overall credibility of a source?* **RQ3.** *How does using the phrase anonymous source v. unnamed source affect the overall believability of a source's innocence?* **METHOD:** This experiment used a 2 x 4 between-subject design. The four independent variables were anonymous source, unnamed source, anonymous source with reason for anonymity, and named source. The two dependent variables were perceived credibility and believability measured by a 17-question survey. **RESULTS:** This study found the use of an 'unnamed source' predicts decreased story credibility, the use of an 'unnamed source' was less credible than the use of an 'anonymous source,' and source credibility had a significant effect on overall story credibility. **CONCLUSION:** This experiment utilized 80 participants, however, results will be updated within the next month after adding an additional 80 participants. Future research is needed in sourcing's effects on news credibility.

## CULTURAL DIFFERENCES IN ATTENTIONAL SELECTION AND VOLITIONAL CONTROL DURING FILM VIEWING

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**BACKGROUND AND PURPOSE:** Research has shown East/West cultural differences in attentional selection using photographs, but never using film. Film allows for the examination of attentional selection in real-world scenarios. Selective attention studies using film show participants' eye-movements rarely deviate from focal narrative elements, regardless of participants' comprehension. This suggests that bottom-up features of film, like motion and color, capture participants' attention. Participants' eye-movements were deviating from the focal elements when given a task that was irrelevant to comprehension, highlighting the importance of volitional attention--the ability to consciously control attention. Thus, film is ideal for studying volitional attentional control because participants do not typically use it while viewing film. We asked: 1) Are there cultural differences in attention during film? 2) Is volitional attention cognitively demanding across cultures? **METHOD:** Participants from Kansas and Japan were eye-tracked while viewing film clips with differing task goals and levels of attentional demand. Participants' primary task was to watch a film clip for comprehension or draw a map of the film space from memory. Participants had a secondary task (cognitive load) on half the trials to increase attentional demand. **RESULTS/FINDINGS:** There were significant main effects on attentional selection for culture, condition, and cognitive load. There was also a significant interaction between cognitive load and condition type for Kyoto participants. **CONCLUSION:** There were cultural differences in attentional selection when using film, as shown by eye-movements. We also found evidence for volitional attentional control in both cultures. Thus, attentional selection was different between cultures, but attentional control strategies were consistent across both.

## **DISSEMINATION OF TEXTILE AND APPAREL ENVIRONMENTAL INFORMATION: IS FACEBOOK POTENTIALLY ENGAGING?**

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**BACKGROUND AND PURPOSE:** Textile and apparel (TA) industry is being highly criticized for its negative impact on the environment. A combined effort from all major stakeholders of the TA supply chain is imperative to reduce the harmful impact of the industry. However, without conscious participation of the consumers, the effort of cleaning up the TA supply chain might be hindered. Facebook, a popular social networking site platform of information generation and dissemination, can play an important role in making conscious consumer. The purpose of this study is to investigate what formats and the contents of TA industry-related environmental information posted on a Facebook page leads to a higher level of engagement. **METHOD:** Nine pieces of information were selected from available sources (i.e., YouTube, websites etc.) for each of four vital aspects of TA environmental sustainability: water, chemical, energy and waste. The information was posted in three different formats namely video, infographic and weblink (text) over two weeks on an experimental Facebook page. The researcher was the creator and admin of the page. Data was collected from a convenience sample of 46 US participants, aged 18-35 (millennial cohort). The participants were instructed to indicate their level of engagement using a system of responses. **RESULTS/FINDINGS:** The aggregate engagement scores following this system revealed that participants engaged more in video format followed by infographic and weblink. On the other hand, participants engaged more in water-related content closely followed by waste-related content. **CONCLUSION:** Social media campaigners of TA environmental sustainability can utilize the findings to set information dissemination strategies.

## **BACK TO THE DRAWING BOARD: EXPLORING DRAWING AS A PATH TO EXPAND IMAGINATION AND CREATIVITY**

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**BACKGROUND AND PURPOSE:** Environmental design is a field that relies on imagination and creativity to produce ideas for creating spaces and places. Designers must actively develop their imagination to design for the complexity of the world. One activity that expands creativity is drawing. Drawing and art-making encourage abstract thought and increases the connections in the brain. Because of these aspects, drawing has the potential to develop the mind's eye. The study attempts to answer the research question "How does the act of drawing as art affect a designer's creativity during the environmental design process?" **METHODS:** This study used an experimental design to assess what effect drawing as art has on creativity and imagination. Both the control and intervention groups were given a five-minute creativity test. The intervention group was treated with a ten-minute drawing intervention beforehand. **RESULTS AND CONCLUSION:** The preliminary test results (N=15), were assessed based on the levels of fluency, originality, flexibility, and elaboration. Both groups were found to have similar scores for fluency and flexibility, but the intervention group scored significantly higher on originality and elaboration. The results showed that the intervention group was more likely to have a higher average score than the control group. Overall the intervention group had higher creativity than the group who did not participate in drawing. Students who participate in drawing as art increase their creativity in the design process more than those who do not draw.

## A NEW NUTRITION TRACKING SYSTEM IMPACTS COLLEGE STUDENTS' EATING PATTERNS AND PHYSICAL ACTIVITY BEHAVIORS

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**BACKGROUND AND PURPOSE:** An overconsumption of fat, added sugars, and salt and lack of physical activity have been associated with preventable chronic diseases in the U.S. Nutrition Banking is a new concept using a monetary system, *Wise Bucks*, to evaluate the consumption of these nutrients and physical activity behaviors. This pilot study examined the impact of Nutrition Banking on college students' eating patterns and physical activity behaviors. **METHOD:** Sixteen first and second year college students, majoring in nonhealth-related programs, were randomly assigned to a control or intervention group. The intervention group attended four presentation sessions on Nutrition Banking while the control group did not attend any sessions or receive any information on Nutrition Banking. All participants submitted their weekly dietary and physical activity logs. At the end of the study, all participants attended the final dining experience where their food choices were observed to see the difference. **RESULTS/FINDINGS:** The intent for increasing fruit and vegetable consumption ( $t(16)=-2.40, p=0.03$ ) and physical activity behavior ( $t(16)=-2.44, p=0.03$ ) in the intervention group is significantly higher than that in the control group. A decrease of total sugar consumption was observed in the intervention group but not at a significant level. The total sugar consumption in the control group did not change; thus, the total sugar consumption in the intervention and control group is not significantly different ( $t(16)=0.386, p=0.705$ ). **CONCLUSION:** Nutrition Banking could help college students be aware of their consumption of fat, added sugars, salt and lack of physical activity to develop a healthy lifestyle.

## PARENT-CHILD SYNCHRONY AS A PREDICTOR OF DIETARY RESEMBLANCE IN THE FAMILY, LIFE, ACTIVITY, SUN, HEALTH, AND EATING (FLASHE) STUDY

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**BACKGROUND:** Dietary intake tends to aggregate in families. The degree to which children's health behaviors resemble parents' behaviors may be moderated by the parent-child relationship. It is unknown whether mutual agreement regarding the responsiveness and reciprocity of the relationship (parent-child synchrony, PCS), predicts parent-child dietary resemblance. **PURPOSE:** The primary purpose of this study was to determine whether PCS was predictive of resemblance between parent and child dietary intake. A secondary aim was to determine whether the healthfulness of dietary intake in adolescents was associated with parenting style. **METHOD:** Data were from the Family Life, Activity, Sun, Health, and Eating (FLASHE) Study, a cross-sectional survey of parents ( $n=1,773$ ) and their adolescent children ( $n=1,641$ ). Parent-child synchrony was operationalized as concordance between the parent and adolescent responses to six parenting-style statements. To determine whether PCS was predictive of dyadic dietary resemblance, multinomial logistic regression was used. **RESULTS:** Parent-child synchrony and junk food intake were positively related ( $OR=1.430, p=0.006$ ), but not other dietary factors. Adolescent intake of fruits, vegetables, and whole grains was positively associated with positive parenting-style ( $ps<0.01$ ). Adolescent intake of fruits was negatively associated with adverse parenting-style ( $p=0.002$ ), while sugar and junk food intake were positively associated with adverse parenting-style ( $ps<0.001$ ). **CONCLUSIONS:** These results suggest that high PCS may increase the likelihood that adolescents will resemble their parents with regard to junk food intake. Parent-child synchrony may be important to consider for reducing adolescent junk food intake, and future studies should investigate the feasibility of intervening on PCS and diet simultaneously.

# CUSTOMER MISTREATMENT AND SOCIAL MEDIA MANAGER JOB SATISFACTION AND BURNOUT

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**BACKGROUND AND PURPOSE:** Today, social media is a preferred customer service channel where customers can seek resolution to issues and share feedback with brands. Previous research in face-to-face customer service contexts reveals that employees tend to experience high levels of customer aggression – yelling, insults, cursing, bullying - that often lead to negative employee outcomes such as burnout, emotional distress, exhaustion, absenteeism, increased turnover intentions and reduced job satisfaction. A critical need exists to expand our understanding of the types of customer mistreatment social media managers experience online, the frequency at which they occur and whether the behavior has the potential to contribute to negative employee outcomes. **METHOD:** 300 professional social media managers are being recruited from industry organizations and clubs to take an online survey about the types of negative customer behavior experienced in the course of their work, how often they occur and their opinions about such customer interactions. **RESULTS/FINDINGS:** It is anticipated that social media managers do experience online customer mistreatment that significantly impacts job satisfaction and leads to burnout. This study will also analyze the relationship between negative employee outcomes and employee emotions or moods and social support from peers, co-workers and supervisors. **CONCLUSION:** Aggressive customer behavior online has the potential to be quite stressful for social media managers and problematic for brands. Results of this study could indicate the need for additional service training and support for social media managers.