



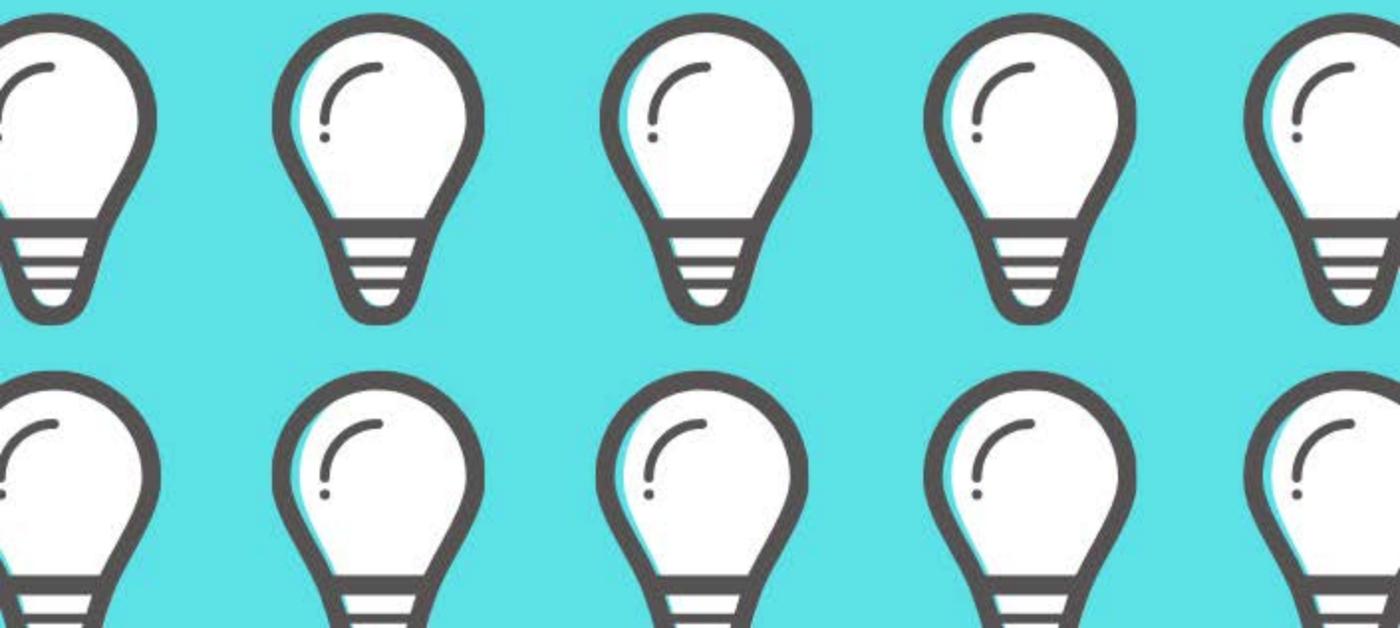
OFFICE OF UNDERGRADUATE  
RESEARCH AND CREATIVE  
INQUIRY

# ***DEVELOPING SCHOLARS PROGRAM***

20th Annual Research Symposium

Abstract Booklet

2019 - 2020



## Table of Contents

---

3. <a href="#">Roger Abernathy</a>	38. <a href="#">Emireth Monarrez</a>
4. <a href="#">Moises Alvarez</a>	39. <a href="#">Diana Najera</a>
5. <a href="#">Cesar Aparicio</a>	40. <a href="#">Jared Newell</a>
6. <a href="#">Nhicolas Aponte</a>	41. <a href="#">Citlally Orozco</a>
7. <a href="#">Byrant Avila</a>	42. <a href="#">Gina Reyes</a>
8. <a href="#">India Barnett</a>	43. <a href="#">Dallas Rice</a>
9. <a href="#">Sonia Barrett</a>	44. <a href="#">Bradley Richards</a>
10. <a href="#">Ayana Belk</a>	45. <a href="#">Jacob Rico</a>
11. <a href="#">Nyah Brandon</a>	46. <a href="#">Citlali Rocha</a>
12. <a href="#">Elena Carlos</a>	47. <a href="#">Julia Romo</a>
13. <a href="#">Richard Carmona</a>	48. <a href="#">Esvin Ruiz</a>
14. <a href="#">Jaden Castinado</a>	49. <a href="#">Emmanuel Serrano</a>
15. <a href="#">Adan Cernas</a>	50. <a href="#">Laura Soto</a>
16. <a href="#">Luz Cobian</a>	51. <a href="#">Briana Thompson</a>
17. <a href="#">Michelle Coca</a>	52. <a href="#">Vu Vo</a>
18. <a href="#">Sergio DePena</a>	53. <a href="#">Derrius Washington</a>
19. <a href="#">Blanca De La Torre</a>	54. <a href="#">Brooke Crawford</a>
20. <a href="#">Cristian Erives</a>	55. <a href="#">Elizabeth Hohn*</a>
21. <a href="#">Melissa Gaona</a>	56. <a href="#">Kyle Kramer*</a>
22. <a href="#">Jerica Garcia</a>	57. <a href="#">Matthew Culbertson*</a>
23. <a href="#">Leo Garrido</a>	58. <a href="#">Megan Keenan*</a>
24. <a href="#">Emily Gibson</a>	59. <a href="#">Mira Bhandari*</a>
25. <a href="#">Joanne Gomendoza</a>	60. <a href="#">Alison Payne*</a>
26. <a href="#">Jesus Gonzalez-Morales</a>	61. <a href="#">Anya Wesely*</a>
27. <a href="#">Vanessa Hernandez</a>	62. <a href="#">Alex Andresen*</a>
28. <a href="#">Tommy Herrera</a>	
29. <a href="#">Alayshia Jacobs</a>	
30. <a href="#">Daijah Jones</a>	
31. <a href="#">Raul Leyva</a>	
32. <a href="#">Luis Lopez</a>	
33. <a href="#">Nancy Lopez</a>	
34. <a href="#">Erick Martinez</a>	
35. <a href="#">Veronica Mateo</a>	
36. <a href="#">Jared Medina</a>	
37. <a href="#">Azriel Minjarez</a>	

\*Denotes high school presenters

**Effect of Tick Saliva from *Amblyomma americanum* on Cancer Cell Proliferation**

Roger Abernathy, Kristopher Silver, and Berlin Londono

Department of Entomology

College of Agriculture

Previous studies report that lipocalins promotes breast cancer progression by upregulating fibronectin (Yang et al., 2009), and silencing of this lipocalin inhibits cell migration in breast cancer (Hu et al, 2018). Several lipocalins also have protease inhibitory properties and interact with tumor specific proteases, suggesting another interaction pathway between lipocalins and cancer cells (Bratt, 2000). We recently found at least three lipocalins differentially expressed in ticks collected from the field versus a maintenance colony, which suggests host-arthropod interactions. Since ticks utilize long-term feeding and have countermeasures against hemostatic responses from the host (Fontaine et al. 2011), the salivary components exert-long term effects on neighboring cells. In our recent study, tick saliva activated enolase 2 in neuroblastoma cell line. Expression ENO2 is related with clinical features of acute lymphoblastic leukemia patients (Liu et al. 2018). Caspase 3 was elevated in neuroblastoma cell in relationship to the controls. Activated caspase 3, a key executioner in apoptosis, is involved in the growth stimulation of tumor cells (Slee, Adrian, & Martin, 2000). Conversely, substantial tumor sensitivity to radiotherapy was observed when a deficit of caspase 3 existed within tumor cells (Huang et al., 2011). When evaluating the effect of tick saliva in epithelial cells, a significant upregulation of fibronectin was observed in comparison to the control cells.

**Hypothesis:** In this study, we propose to evaluate the expression of caspase and enolase 3 in three carcinoma cell lines. The effect of immunity against tick saliva in the expression of genes will also be tested.

**Joke's on You?: Heterogeneity of the Majority and Perceptions of Racial Humor**

Moises S. Alvarez, Tiffany Lawless, Ashley Schiffer, Stuart Miller and Donald Saucier

Department of Psychological Sciences

College of Arts and Sciences

Humor disparaging White people is perceived by White people as less racist and offensive, and more funny, than humor disparaging Black people (Saucier et al., 2016). This may be due to individuals perceiving White people (the majority group) to have more intragroup variability than minority groups (Harper, 2008). This perceived variability may be protective – White people may not be offended because they perceive jokes disparaging White people as disparaging different White people. Minority group members, however, may not similarly benefit. In Study 1, we used jokes about Black and White people and asked participants how acceptable, funny, and offensive the jokes were in addition to measuring perceptions of group homogeneity. To improve external validity, in Study 2, we paired each joke with a “presenter” (a picture of either a White or Black person). We found perceptions of a group as homogenous were associated with finding jokes about them more offensive. We replicated the results of Study 1 and additionally found that there was a significant interaction between presenter race and target race such that jokes about a Black person presented by a White presenter were found to be more racist. When disparaging racial humor is used against members of a group higher on the social hierarchy, it is perceived as more funny, less offensive, and less racist than when used against members of a group lower on the social hierarchy. This may be the case because lower status groups are viewed more homogeneously and are more vulnerable to attack.

**Stimuli-Responsive Platinum (IV) Micelles for Programmed Cell Death**

Cesar B. Aparicio Lopez, Ramesh Marasini, Tuyen Duong Thanh Nguyen, Sagar Rayamajhi,  
Santosh Aryal

Department of Chemistry, Nanotechnology Innovation Center  
College of Arts and Sciences

Cisplatin is a first-line chemotherapeutic drug routinely used for cancer management; it inhibits DNA repair mechanisms to induce programmed cell death. However, its severe side effects and tumor resistance due to overuse have lowered the efficacy of cisplatin. Over several years, many efforts have been made to improve the effectiveness of this drug. Several prodrugs have been made with the hope of enhancing its anti-cancer performance while minimizing non-specific toxicity. However, the complex cellular network in tumors makes it extremely challenging to target cancerous cells. In addition, the distinct physiological conditions of a tumor microenvironment such as hypoxia, acidic pH, and interstitial pressure make drug delivery to cancerous cells extremely difficult. To tackle these problems, we designed novel platinum (IV)-based micelle that will activate specifically under the tumor physiological environment. We hypothesize that the features of a tumor microenvironment (bio-reduction, hypoxia, and pH) can trigger the release of cisplatin from the proposed platinum (IV) micelles at the target site with precision. To achieve this goal, we have utilized multi-step chemical reactions to convert commercial cisplatin drug into derivatives equipped with a hypoxia-sensitive molecule and a pH-responsive polymer chain. By virtue of design consideration, an amphipathic molecule undergoes self-assembly to form a micelle that provides protection to the platinum bioactive agent and will only be released in the tumor. Using the proposed strategy, the chemotherapeutic delivery efficiency would be improved while reducing the non-specific side effects. Currently, we are working to optimize and confirm the substituents of the derivatives. Then, measure the efficiency of each platinum derivatives in-vitro using various cancer cell lines.

**Layered wicks enable passive transport of condensation out of cooling systems**

Nhicolas Aponte, Jordan Morrow, Gennifer Riley, Partha Chakraborty, Melanie M. Derby

Department of Mechanical and Nuclear Engineering

Carl R. Ice College of Engineering

Cooling systems, like condensers or cooling towers of a power plant, transfer heat out of a system. The cooling process often occurs through the condensation of water, which forms a liquid film that reduces heat transfer; a problem that makes cooling systems larger and more costly. The solution studied in this work is the use of capillary/surface tension forces to passively transport water in a wick. In this project, we compare wicking structures with different porosities in order to design an effective wick for condensation. For a rate-of-rise test, the wicks are lowered into a water reservoir and interactions between the wick and the water are observed and recorded using a high-speed camera. Then, the height the water rises to within the wick is compared. The experimental wicks are 3-D printed onto a 14.0 mm x 30.0 mm x 2.0 mm test plate, which allows the fabrication of complex geometries. The wicks used have the same structure of arrays of layered spheres bridged by cylindrical columns, with sphere radii of 0.5 mm, 0.75 mm, and 0.875 mm. In previous experiments, the wicks were built in layers parallel to the test plate. The current iteration of layered wicks were built to form a column normal to the test plate. This also eliminates any capillary effect produced by the test plate in previous experiments. The success of this project could improve the heat transfer in space cooling systems and power plant condensers.

**Production and Purification of Aromatase for Co-Crystallization with Potent Inhibitors  
AR11 and AR13**

Bryant Avila, Raul Leyva, Ho-Leung Ng  
Department of Biochemistry and Molecular Biophysics  
College of Arts and Sciences

(CYP19) is a cytochrome P450 enzyme that catalyzes the conversion of androgens to estrogens. Inhibiting this enzyme is one current approach to treating breast cancer. Current antineoplastic therapeutics often produce unwanted patient side effects, thus creating a need for new, more efficacious drugs. We produced CYP19 mutants L240S, G156A, and V80S, which will be co-crystallized with two of our lab's potent inhibitors: AR11 and AR13. We anticipate these mutants will increase the likelihood of producing protein-inhibitor crystals. Producing a crystal structure of aromatase is a fundamental step in rationally designing new drugs for the treatment of hormone-dependent breast cancer.

**Immunohistochemistry (IHC) of Breast Cancer Cells**

India Barnett, Thu Annelise Nguyen

Department of Diagnostic Medicine/Pathobiology

College of Veterinary Medicine

The T47D human breast cancer cell line was purchased from American Type Cell Culture (ATCC, Manassas, VA). Cells were grown in RPMI medium supplemented with 10% fetal bovine serum (Atlanta Biologicals, Lawrenceville, GA) at 37° C with 5% CO<sub>2</sub> in T-125 cm<sup>2</sup> flasks. Xenograft tumors of T47D cells in nude mice Nu/Nu female mice were ordered from Charles River Laboratories International, (Wilmington, MA, USA) and implanted with 17-β-estradiol (1.7 mg/pellet, Innovative Research of America, Sarasota, FL) before injection of 1x10<sup>7</sup> T47D breast cancer cells subcutaneously into the inguinal region of the mammary fat pad. Cell viability of T47D cells was performed prior to the injection. Tumor size was measured in two dimensions with calipers every 2 days starting at day 7. Tumor volume was determined by the equation: Volume = ½(Length)\*(Width)<sup>2</sup>. Mice were observed for any change in behavior, appearance or weight. When tumors reached >50 mm<sup>3</sup>, six animals were randomly assigned to each treatment group. Mice were administered 25 mg/kg PQ1 or PQ7 in succinic acid salt, 10 mg/kg Paclitaxel, or a combination of PQ and Paclitaxel via intraperitoneal injection of 100 µl. Compounds were dissolved in DMSO, which was used as a vehicle control at the same volume. Tissue was harvested from mice two days after the last injection.

**Vancomycin Functionalized Surfactant Mesoporous Silica Nanoparticles(MSN)**

Sonia Barrett, Lauren Chlebanowski, Stefan H. Bossmann

Department of Chemistry  
College of Arts and Sciences

Bacterial antibiotic resistance is becoming a rising problem since the first antibiotic was created. This becomes further aggravated due to improper over prescription to treat common infections. Because of this, pharmaceutical companies and academic research labs must keep making stronger antibiotics to combat the resistant bacteria that emerge. A possible solution are surfactants. Surfactants are a large group of organic compounds with characteristic hydrophilic heads and long hydrophobic carbon chains. Surfactants are commonly used for lowering surface tension and as foaming agents; however, they are also known for having antimicrobial activity. Antimicrobial activity is due to the long hydrophobic carbon chains that can pierce through the lipid bilayers that make up bacteria cell membranes and cause cytoplasmic leakage, lysis of the cell wall, and leading to cell death. A common commercially available surfactant is benzalkonium chloride (BAC) and is regularly used in topical antiseptics, cleaners and as a preservative. Mesoporous silica nanoparticles, or MSNs, are versatile drug delivery vessels that can uptake a variety of drugs in simple one pot synthesis and can be further functionalized using gate keepers. Gate keepers can be used for targeted drug release at the site of infection and control drug release time. In this project BAC loaded MSNs functionalized with Vancomycin acting as a gatekeeper are synthesized. Vancomycin is a large compound that can sterically hinder BAC from being released until the MSN is broken down by bacteria. These functionalized MSNs are tested against the model pathogen *Micrococcus luteus* to test for their effectiveness in killing bacteria. In future work MSNs loaded with various surfactants will be synthesized and possible use of different bulky gatekeepers to functionalize the outside of MSNs will be considered.

**Reviving Troost Avenue by Activating Vacant Lots in Kansas City, MO**

Ayana Belk, Anne Beamish

Department of Landscape Architecture and Regional & Community Planning  
College of Architecture, Planning, and Design

Troost Avenue was once an attractive and desirable place to have a business in Kansas City, Missouri. Today, the street is run-down, with many vacant lots and serves as a racial and economic dividing line between the east and west sides of the city. Through research, I have come to understand the historical context of Troost Avenue and explored "urban acupuncture" as a feasible solution to Troost's vacant lot epidemic. "Urban acupuncture" is a theory that views cities as living, breathing organisms and argues that designed spaces can serve as "needles" that revitalize a community. By conducting several precedent analyses of activated vacant lots, I have learned that cities can develop a vibrant urban environment by giving communities what they might be missing: green space, community gardens, quiet space, or social space. The question that drives this project is: **How might a vacant lot on Troost Avenue be transformed into a pocket park that would be an asset and amenity for the local community?** To ensure that my design is indeed valuable and functional, I will use some of the goals for the Troost Corridor Priority area outlined in the Kansas City - Catalytic Urban Redevelopment (KC-CUR) Implementation Strategy Report to guide my design. This project will aim to use the knowledge gained from precedents, documentation of current site conditions and archival research into Troost to guide and transform the site into a pocket park that is a safe and functional community amenity that encourages social interaction.

**Development and Application of an Olfactory Lexicon for Coffee**

Nyah Brandon and Kadri Koppel

Department of Food, Nutrition, Dietetics and Health

College of Health and Human Sciences

Coffee is one of the most popular drinks in the world. Specialty coffee is the green bean that has no defects and has a distinctive character. There are two species of coffee with economic significance: Arabica and Robusta. Several studies have looked at sensory properties of coffee, and few have studied volatile compounds of coffee brews using Gas Chromatography-Mass Spectrometry-Olfactometry (GC-MS-O). GC-MS-O uses human assessors as sensitive and selective detectors for odor-active compounds. The objectives of this study were to a) develop a GC-MS-O lexicon for specialty coffee brews, and b) evaluate specialty coffee samples volatile compounds odor characteristics using the lexicon developed. GC-MS-O with a modified headspace solid-phase micro extraction (SPME) method was used to analyze coffee samples from Tolima, Colombia, prepared by two different brewing techniques (French press & automatic drip coffee) with different roast profiles (light, medium, & dark). Three trained panelists from the Center of Sensory Analysis and Consumer Behavior analyzed all samples in duplicate. Two Orientation sessions were conducted with references for each aroma attribute. Total of 23 aroma attributes were detected from the 33 volatile compounds. The most frequent attributes were sweet, leather, musty, buttery, and sweaty. Light French, Medium Drip, and Dark French all had the highest number of the attribute sweet. Dark roasted coffee lacked volatile compounds, explaining the fewer attributes than in light roasted coffee. This research will help us better understand specialty coffees and the specific compounds that contribute to a perceivable aromatic.

**Phlebotomy-Induced Reductions in Hematocrit and Hemoglobin: A Quasi-  
Experimental Study**

Elena Carlos, Trevor Steele, Catherine Steele, Sara Rosenkranz  
Department of Food, Nutrition, Dietetics & Health  
College of Health and Human Sciences

**Background:** Phlebotomy-induced anemia is common in hospital settings. There are ethical concerns regarding similar potential for phlebotomy-induced reductions in iron status in research settings. Therefore, the purpose of this study is to utilize an ongoing clinical study involving serial blood sampling to determine whether hemoglobin and hematocrit levels decrease over the study duration.

**Methods:** Participants (18–65yrs, n=20) with a body mass index  $>23$  kg/m<sup>2</sup> will be recruited for a 3–6 week trial in which they will be given different test beverages at 6 different time points. Participants will be required to fast 10-12hrs before coming to the testing facility. Following a 10–12hr fast, they will undergo a blood glucose test, where blood samples to be taken intravenously from a forearm vein at 7 time intervals (study total = ~350ml blood). Hematocrit and Hemoglobin will be assessed at baseline and at the final visit from venous whole blood.

**Results:** Results will determine the effects of repeated phlebotomy over a short time period, on hemoglobin and hematocrit levels. We hypothesize that there will be no changes in hemoglobin or hematocrit levels, indicating low risk for phlebotomy-induced anemia within the context of clinical research studies conducted within our laboratory.

**Conclusion:** These results will contribute to understanding the best practices, when repeated blood draws are necessary, in order to reduce any potential risk of phlebotomy-induced anemia. Future studies should examine whether there are cut-points for total blood sample volume or study duration that could put participants at risk for phlebotomy-induced anemia.

**Extraction of Recipe Steps from Scientific Papers: The Nanomaterials Synthesis Domain**

Richard Carmona-Andrade, Huichen Yang, Derek Christensen, William Hsu

Department of Computer Science

Carl R. Ice College of Engineering

The overall goal of this research is to effectively extract steps for performing a specified procedure from published text descriptions, producing a recipe listing the materials, operations, and conditions required to perform the procedure. For example, if the procedure is to create a nanomaterial, and relevant source text consists of peer-reviewed scientific publications, a recipe should include raw materials and unit operations, among other specifications of a chemical engineering process. This project focuses on developing performance measures to evaluate recipe steps, by gauging their correctness, completeness, and non-redundancy. This is done by comparing manually annotated documents that conveyed desired results to automatically extracted steps, and finding any discrepancies to improve on how recipes are organized. Each annotator manually compiles a set of reference recipes to compare against automatically extracted ones, tallies errors based on a standard developed in collaboration with subject matter experts, then audits a different set of scientific papers marked up by another annotator. This auditing process allows a group of annotators to mutually check each other's work to ensure that recipes are correctly compiled. A corpus of experimental documents was collected using a web crawler from open access web archives. These documents were filtered to determine which ones are scientific papers, ranking them by relevance, and finally, dividing and extracting structured information about the specified ingredients and steps. My main task in this research is to measure the impact of improved extraction rules on the rate of steps correctly captured.

**Safety standardization and heat stability of household icings and frostings.**

Jaden Castinado; Karen Blakeslee; Linda Beech; Fadi Aramouni

Department of Animal Science and Industry

Food Science Institute

College of Agriculture

The safety and stability of icings and frostings produced by home cooks is a growing concern for judges and contestants at Kansas state and county fairs, and small businessowners. Outdoor environments expose the products to prolonged exposure of ambient and high temperatures without refrigeration, reducing the effect of temperature as a safety control measure. In this study, frosting and icing recipes from home bakers were gathered through the K-State Research and Extension network. Batches were created in duplicates, tested for Brix, pH, Aw, and mold growth at 42 °C for 48 hours, and then compared with the federal guidelines of classification for non-potentially hazardous (NPH) foods of  $A_w > 0.85$  or  $pH \leq 4.2$ . From a sample size of  $n=47$ , all samples are considered NPH with no mold growth except 1 sample as potentially hazardous (PH) and 1 sample exhibiting mold growth. The goal of these trials is classify samples as either NPH or PH, create a resource to educate home bakers, and collaborate with K-State Extension as to establish and provide guidelines for the safety and stability of common icings and frostings.

**Freezing in Heat Pipes, Images of Textured Surfaces**

Adan Cernas, Emily Stallbauhmer, Melanie Derby  
Department of Mechanical and Nuclear Engineering  
Carl R. Ice College of Engineering

Heat pipes can be used to cool electronics in NASA shuttles, yet the heat pipes can still manage to freeze in space and cease functioning. Heat pipes can be found in a variety of electronics. We, however, are examining the mechanism of the heat pipe as well as the wick structure. Our goal is to understand and mitigate the effects that cause the freezing that occurs within the heat pipes itself. By doing this, we hope that they can run a lot more efficiently. We are doing this by first setting up a controlled environment of 20 degrees Celsius, 60% relative humidity and setting the peltier cooler to -5 degrees Celsius then we proceed to put the heat pipe under a confocal microscope, then simulating the freezing temperatures of space by using a peltier cooler (which is a temperature-controlled mount). We look at the images from the microscope and determine how long it takes for freezing to occur. Then we repeat the process to see if the result we get can be repeated. We have had 3 test types; sintered wick, grooved wick, and plain copper. Each type has multiple pieces that we test.

**Genetic Engineering of Fungal Hydrophobins HFBI and HFBII for Production  
from *Escherichia coli***

Luz Isabel Cobian Lepe, Erin Hackenberg, Dongam Jeong, Won Min Park,  
Tim Taylor

Department of Chemical Engineering  
Carl R. Ice College of Engineering

Hydrophobins are amphiphilic proteins that are naturally found in filamentous fungi. Their properties have been studied, and they have shown potential to be useful in the food industry regarding foams and in the medical industry regarding slow-releasing drug delivery mechanisms. While the benefits of hydrophobins are actively explored, the production of hydrophobins remains a challenge for rapid economic production. There are different approaches for improved production, and genetic cloning for expression and production of hydrophobins in different organisms is a promising approach. Recombinant DNA technology provides a way to artificially construct DNA that express proteins in other organisms. By using the recombinant DNA technology, a DNA fragment that encodes hydrophobin can be inserted and the recombinant DNA plasmids will express the protein. Here, I present a research about cloning of the gene for a specific hydrophobin, HFBI, for expression in *Escherichia coli*. To begin, DNA fragment insert was synthesized, amplified by PCR, digested, and ligated into a bacterial vector plasmid. After transformation, the *E. coli* bacteria were cultured on agar plates with ampicillin, which selected the bacteria colonies that contained the transformed plasmids. After isolation of the DNA plasmids and digestion by restriction enzymes, a gel electrophoresis was run with a sample size of plasmids to determine if the correct sequence was inserted into the plasmid template. The samples with correct insert sizes were confirmed by sequencing. Further steps to produce hydrophobins will be to express and analyze expression profiles in *E. coli*. Optimization of the production of hydrophobins using recombinant DNA will bring out the full potential of hydrophobins.

**Endocytosis Inhibitors Do Not Block Iron Uptake in Cultured Insect Cells.**

Michelle E. Coca, Maureen J. Gorman

Department of Biochemistry and Molecular Biophysics

College of Arts and Sciences

Iron is essential for energy metabolism and other physiological processes of all organisms; however, because it can also be toxic, iron uptake must be strictly regulated in all cells. In humans, there is a well-understood mechanism of iron uptake and multiple poorly understood mechanisms. How iron is transported into insect cells is unknown. The goal of this study was to test one of several possible models of iron uptake by cultured insect cells. This model involves endocytic uptake of protein-bound iron. For this experiment, the cells used were Sg4 cells, an isolate of the well-studied *Drosophila melanogaster* S2 cell line, growing in Schneider's medium supplemented with 10% fetal bovine serum. Cells were treated with 5 mM methyl- $\beta$ -cyclodextrin, an inhibitor of caveolae-dependent endocytosis, and the effect on cellular iron content after 72 hours was measured. Results showed no effect of the endocytosis inhibitor on cellular iron content, suggesting that iron uptake by Sg4 cells does not seem to involve endocytosis. Therefore, our tentative conclusion is that iron uptake must occur through mechanisms other than endocytosis. This conclusion is supported by our previous finding that bafilomycin A1 had no effect on cellular iron content. A better understanding of iron uptake in insects could lead to better insect control strategies as well as provide insight into the less understood iron uptake mechanisms in humans.

**Rule of Fidelity to Treatment in Mental Health**

Sergio DePena and Joyce Baptist

Department of Family Studies and Human Services

College of Health and Human Sciences

The rates of depression and suicides in the U.S. is on the rise. In the U.S. Suicide is the second leading cause of death for people in between the ages of 10 and 34, while depression is one of the most common mental disorders in the U.S. There is a need for more effective treatments for both depression and suicidality. In this study that compares the efficacy of Cognitive Behavioral Therapy (CBT) and Eye Movement Desensitization and Reprocessing Therapy (EMDR), we have seen a decrease in depression and suicidal thoughts post-treatment for both arms. A necessary component of manualized treatments is ensuring fidelity to therapy protocol. This study examines the relationship between treatment fidelity and treatment outcomes. Understanding this relationship would allow us to identify aspects of the protocol that may be challenging for the therapist to adhere to as well as have insight as to the relationship between adhering to the protocol and outcome of the treatment.

**The Relationship between Heart Rate and Rate of Perceived Exertion in High Intensity Functional Training**

Blanca DeLaTorre, Justin A. DeBlauw, Brady K. Kurtz, and Katie M. Heinrich  
Department of Kinesiology  
College of Health and Human Sciences

Monitoring exercise intensity via rating of perceived exertion (RPE) and heart rate (HR) helps optimize exercise adaptations. Since high-intensity functional training (HIFT) follows a constantly varied and mixed modality format and use of HR and RPE is uncommon, it is unclear if completing a HIFT workout disrupts the usual linear relationship between HR and RPE.

**PURPOSE:** Determine if a linear relationship exists between HR and RPE during a HIFT workout. **METHODS:** Fourteen participants (50% female; HIFT experience =  $27.6 \pm 5$  months; age =  $25.6 \pm 4.4$  years) completed a standardized warmup. Next, they completed three rounds of a HIFT workout (10 dumbbell thrusters, 10 air-squats, 10 burpee-box jumps), reporting RPE (6-20) after each round, with HR continuously monitored. Participants completed an online follow-up questionnaire regarding length of HIFT participation, previous RPE use during workouts, and previous coaching on RPE. **RESULTS:** HRs per round (R) were  $176.9 \pm 9.2$  (R1),  $182.2 \pm 9.9$  (R2) and  $186.8 \pm 10.3$  (R3). RPE for each round was  $15 \pm 2$  (R1),  $16 \pm 2$  (R2), and  $17 \pm 2$  (R3). There was no significant relationship between HR and RPE at the end of each round when controlling for HIFT experience, previous coaching and use of RPE. Both RPE and HR increased after each round, however RPE was below expected values. **CONCLUSIONS:** HIFT athletes perceived the workout at a lower intensity than their measured HR. The lack of HR and RPE guidance in typical HIFT workouts may explain this disconnect. Future studies should examine strategies to improve the reliability of RPE relative to HR for HIFT to improve their relationship.

**Influence of Blood Flow Occlusion on Central Motor Drive During Maximal-Effort Handgrip Exercise.**

Cristian Erives, Shane Hammer, and Thomas J. Barstow  
Department of Kinesiology  
College of Health and Human Sciences

Intro: Blood flow occlusion results in greater metabolite-induced development of peripheral fatigue during exercise which is thought to limit central motor drive (CMD). However, it remains unknown if blood flow occlusion during maximal-effort exercise results in significant restriction to CMD. We hypothesized that 1) blood flow occlusion would significantly reduce CMD and 2) vascular reperfusion would result in significant motor-unit re-recruitment.

Methods: In randomized order, subjects performed a rhythmic single-arm isometric-handgrip maximal-effort test (MET) under control conditions (CON) or during limb blood flow occlusion (OCC) and reperfusion (REP). Electromyography measurements were made continuously during each test and the root mean square (RMS) was used to quantify CMD (i.e., motor-unit recruitment).

Results: RMS at the start of each MET was not different between CON and OCC. RMS remained unchanged during CON suggesting continuous maximal recruitment. However, RMS decreased significantly during OCC ( $p < 0.001$ ) resulting in a RMS at OCC<sub>end</sub> that was significantly lower than at CON<sub>end</sub> ( $p < 0.001$ ) suggesting progressive deactivation of motor-units during OCC but not CON. Following cuff release, RMS increased significantly during REP ( $p < 0.001$ ) resulting in a RMS level at REP end that was not different from CON<sub>end</sub> suggesting a similar level of activation to that of exercise at CF.

Conclusions: These data suggest that exacerbation of metabolite accumulation during blood flow occlusion and subsequent peripheral fatigue development results in significant CMD restriction. Further, metabolite clearance during vascular reperfusion appears to restore maximal levels of CMD.

**Evaluation of various fiber sources as a carrier for use in supplemental nutrient premixes  
in pet and animal foods**

Melissa Gaona, C.G. Aldrich, and Dalton Holt  
Department of Grain Science and Industry  
College of Agriculture

Pet Foods are commonly fortified with vitamin and mineral premixes to adequately supply the micronutrient requirements of the animal. Premixes typically require carriers to ensure proper uniformity, dilution, and dispersal across the entire ration. Rice hulls have been the industry standard; however, growing trends towards “grain-free” pet foods require alternatives. Therefore, the objective of the current investigation was to evaluate the effectiveness of various alternative fiber sources as premix carriers. Apple pomace (AP), blueberry pomace (BP), and miscanthus grass (MG) were evaluated and compared to rice hulls (RH) based on particle size distribution, flowability, and angle of repose. Particle size was  $183\pm 2.44$ ,  $231\pm 2.13$ ,  $182\pm 1.97$ , and  $340\pm 1.8\mu\text{m}$  for AP, BP, MG, and RH, respectively. Apple pomace had the greatest flowability among treatments passing through <26mm diameter orifice, followed by BP passing through 28mm, and MG with the poorest passing through 32mm. However, RH passed through an orifice diameter less than half that of AP at 12mm. For angle of repose, RH had the smallest angle of  $40.24^\circ$  compared to that of AP, BP, and MG at  $44.99^\circ$ ,  $47.91^\circ$ , and  $46.56^\circ$ , respectively. Although AP had an advantage in terms of flow properties among treatments, all three ingredients demonstrated relatively poor handling capabilities compared to rice hulls. A wider array of ingredients and ingredient preparation techniques are needed to identify competitive alternatives to cereal-based carriers like rice hulls. Further analytical testing will also be needed to better characterize these ingredients as potential carrier sources.

**Fun and Fit: Impact of a brief training intervention on children's physical activity during an after school program**

Jerica Garcia and Emily Mailey  
Department of Kinesiology  
College of Health and Human Sciences

After school programs are a promising setting to promote children's physical activity (PA). To evaluate the impact of a brief staff training on PA among children attending an after school program. Two Boys and Girls Club (BGC) after school sites participated in this quasi-experimental study. Four days of data were collected from each site at two time points. Data collection included accelerometer-measured PA of participating children ( $n=27/\text{site}$ ) and direct observation of BGC staff PA encouragement and discouragement. Following baseline data collection, BGC staff at site 1 attended a 30-minute training, which encouraged them to allocate more time to PA and facilitate games to promote PA among all children. Site 2 served as a comparison group. Changes in sedentary time, light activity, and moderate-to-vigorous physical activity (MVPA) were compared between sites. Significant differences between sites were observed for all variables. Relative to the comparison group, children at the intervention site decreased sedentary time by 14.4 min/day ( $p=.04$ , 95%CI=1.3-27.7 min/day), and increased light activity and MVPA by 8.8 ( $p=.007$ , 95%CI=2.7-14.7 min/day) and 6.8 minutes ( $p=.002$ , 95%CI=2.9-10.7 min/day), respectively. The ratio of staff encouragement to discouragement improved from 40% to 94% at site 1, compared to 51% and 59% at site 2.

**Reinforcement Learning for Autonomous Navigation**

Leonardo Garrido and William Hsu

Department of Computer Science

Carl R. Ice College of Engineering

This project deals with autonomous mobile robots trained using reinforcement learning, a branch of machine learning (the science of improving problem-solving performance based on experience) based on choosing actions to maximize rewards from various environments. This is a form of behavioral learning that is observed in nature and thus more biologically plausible than cognitive models based on labeled data provided by a teacher (supervised learning). We developed an experimental test bed by implementing Deep Q-Networks (DQN), a form of reinforcement learning, for goal-oriented navigation and obstacle avoidance tasks using a TurtleBot3 Burger robot and the GAZEBO simulation environment for behavior learning in autonomous agents. To achieve the goal of avoiding obstacles, the DQN Agent provides a positive reward to the robot whenever it gets closer to its goal and a negative reward when it is farther from its goal. The TurtleBot3 Burger requires a large number of training iterations before it achieves the goal and successfully avoids obstacles. Future work involves extending these reward functions so that DQN can be used to learn to solve fully autonomous navigation exploration and mapping tasks, where the robot does not know the exact location of the goal.

**Using *Legionella pneumophila* to Investigate Mechanisms to Restrict *Listeria monocytogenes* Replication**

Emily S. Gibson and Stephanie R. Shames

Division of Biology

College of Arts and Sciences

*Listeria monocytogenes* is a Gram-positive intracellular bacterial pathogen that is found in contaminated food. However, *L. monocytogenes* is unable to replicate in the vacuole of host cells, so makes an enzyme called Listeriolysin O (*hly*), which breaks open the vacuole allowing replication to occur in the host cell cytoplasm. *Legionella pneumophila*, an accidental human pathogen that naturally parasitizes freshwater protozoa, and also replicates within mammalian macrophages, is a model to understand ways to restrict diverse bacterial pathogens. The effector protein LegC4 comes directly from *L. pneumophila* and attenuates *L. pneumophila* replication in cytokine-activated macrophages. We hypothesized that LegC4 will attenuate replication of other pathogens, such as *L. monocytogenes*. To test this hypothesis, *L. monocytogenes*, wild-type and *hly* mutant growth was quantified within RAW 264.7 mouse macrophages that produce LegC4 compared to control RAW 264.7 macrophages. We also treated the cells with either interferon (IFN)- $\gamma$  or tumor necrosis factor (TNF) because LegC4 enhances clearance of *L. pneumophila* macrophages activated with these cytokines. From all the data we collected we found that LegC4 is showing signs of being restrictive towards the replication of *L. monocytogenes* but further experimentation is required. In the future we will be working towards evaluating the impact of LegC4 on *L. monocytogenes* infections of mice to test our hypothesis.

**The Effects of N-acetylcysteine on Amphetamine-Induced Hyperactivity and Glutamate Homeostasis in Differentially Reared Rats**

Joanne Kellie T. Gomendoza, Jared P. Rack, Thomas J. Wukitsch, Troy D. Fort, Mary E. Cain  
Department of Psychological Sciences  
College of Arts and Sciences

Neuronal plasticity can be influenced by differences in rearing environments. To study the effects of the rearing environment on neuronal plasticity animal models in which rats are raised in enriched (EC), isolated (IC), or standard conditions (SC) are commonly used. Research suggests that differential rearing change neuronal plasticity within the mesocorticolimbic pathway influencing the response to drugs of abuse. Differential rearing alters the response to psychostimulants by modifying glutamate receptors that contribute to glutamate homeostasis. N-acetylcysteine (NAC), an amino acid derivative of cysteine, induces recovery of extracellular glutamate levels in order to regulate glutamate homeostasis and decrease relapse to drugs of abuse. We hypothesize that differential rearing and NAC treatment will alter expression of glutamate receptors that contribute to glutamate homeostasis and that the effects of NAC will vary depending on the environmental conditions. In the experiment, male Sprague-Dawley rats were reared in EC, IC, or SC environments. After 30 days of rearing, rats were administered amphetamine (1.0 mg/kg, ip) for 8 days. On days 1 and 8, rats were placed in a locomotor chamber to confirm amphetamine-induced hyperactivity. EC rats had less hyperactivity on day 8 in comparison to the other conditions. After this phase, rats were assigned to a NAC (60 mg/kg, ip) or saline condition for 14 days in the absence of amphetamine and then returned to the locomotor chamber for a final conditioning test. Brains were then extracted, and westerns blots were conducted on the nucleus accumbens (ACb) and the medial prefrontal (mPFC) regions to measure the expression of xCT, GLT-1, and EAAT3. On test day, SC rats that received the NAC treatment had lower mPFC xCT expression but had higher conditioned hyperactivity. Additionally, for IC and SC rats in the NAC treatment group, mPFC xCT and EAAT3 expression were positively correlated. However, for the saline treatment, xCT and EAAT3 expression had a significant positive correlation only in EC rats. Within the ACb, saline treated IC rats with more hyperactivity had lower amount of xCT expression but higher amounts of GLT-1 expression. The results suggest that early rearing environment may play a significant role in reducing amphetamine-induced conditioned hyperactivity due to changes in glutamate homeostasis.

The Electroencephalography (EEG) is a noninvasive test used to evaluate specific electrical brain activity. The device has 64 electrodes that are placed above the participant's scalp. The EEG device is utilized with a P300 speller program. The P300 speller software inputs commands to a computer by user thought, also known as a Brain Computer Interface (BCI). The program allows the participant to pick specific characters with no physical contact. The study was open to anyone, with no specific requirements. Additionally, participants were also asked to put away any electrical devices, so there would be no signal interference. The purpose of this study is to evaluate the latency jitter, which is the delay between stimulus and response. Data from 10 participants were collected with an (EEG) test. The subjects participated in a 3-day session, and were asked to complete 4 sentences per session. The results show that the latency event related potentials (ERP) varied by participant concentration. In conclusion, the P300 face speller and (EEG) can tell us a lot about brain activity, and further research is being done to quantify the latency jitter response.

**Developing an Improved Therapeutic Peptide for Cancer Treatment**

Vanessa Hernandez, Obdulia Covarrubias-Zambrano, Stefan H. Bossmann

Department of Chemistry  
College of Arts and Sciences

Cancer occurs when a mutated single cell continues to divide uncontrollably, developing into one of the more than 200 different cancer types. Currently, cancer is the second leading cause of death worldwide, resulting in 8.2 million deaths. For 2020 in the US only, approximately 750,000 new cancer cases will arise. Current cancer treatments are very costly and cause severe side effects. These treatments include, surgery, chemotherapy, and radiation. This project focuses on the development of an improved therapeutic peptide by combining an effective nucleus penetrating peptide and a highly toxic anticancer peptide, called WTAS-SA-D-K<sub>6</sub>L<sub>9</sub>-AS. This peptide was synthesized and labeled with Rhodamine B, a fluorescent dye used for tracking purposes. HPLC and mass spectroscopy were used for characterization. Cell studies demonstrated that properties of each peptide individually remained after combining both peptides, which include, high toxicity, cell nucleus penetration, and mitochondria targeting. Also, studies demonstrated that the killing mechanism used by this new anticancer peptide occurs via the necrosis pathway only. Overall, this study demonstrated the development of a promising and advanced therapeutic peptide, which could potentially be more efficient than current cancer treatments.

**Where east meets west: Resolution of small mammal diversity across the northern Great Plains**

Tommy Herrera, Litsa Wooten, Fraser Combe, Andrew Hope

Division of Biology

College of Arts and Sciences

Anthropogenic environmental changes, including atmospheric and land-use factors, impact wildlife's distribution and community dynamics. Small mammals serve as a diverse proxy for understanding regional community responses by genetic analyses of distributional change and associated evolutionary interactions. The northern Great Plains of Manitoba, Canada is among the ecosystems most impacted by anthropogenic change, demonstrating climatic and geographic transitions latitudinally and longitudinally, connecting biodiversity between previously isolated eastern and western North American communities. Until recently, few samples of Manitoba's small mammals were available for verification of local populations' genetic identities, a crucial criterion for assessing conservation status. This study seeks delineation of Manitoba's small mammals' genetic lineages to preliminarily assess regional genetic diversity, aiding a continent-wide assessment toward determining biodiversity responses to contemporary environmental change. Field sampling took place over six sites across southern Manitoba in summer 2019, including multiple habitats across known genetic transition zones. Field methods included small mammal specimen collection as voucher records, tissue preservation for genetics, ecto- and endo-parasitic examination for further analyses, and standard morphological measurements all part of a holistic sampling protocol to archive regional diversity. Representative specimens from each site will undergo genetic barcode sequencing to test the taxonomic validity of regional subspecies designations based on earlier morphological distinctions. Phylogenetic analyses, including existing comparative data from GenBank, will allow us to diagnose regional diversity and identify transition areas for future research in hybridization, the spreading of parasites, and zoonotic diseases. Anthropocene environment trends reveal a global, human-mediated biodiversity crisis that may be mitigated through modern scientific knowledge. To this end, small mammal communities play a vital role in revealing evolutionary processes of change across ecological time scales.

**Brothers in Blue Recidivism Rates**

Alayshia Jacobs and Lisa Melander

Department of Sociology

College of Arts and Sciences

Mass incarceration has become a major issue in the United States. Approximately 95% of the people incarcerated will be released back into the community, and a majority of these offenders will reoffend. As such, prison researchers and administrators have developed several reintegration programs such as Brothers In Blue, a faith-based prison program, to ease the transition back into society and lower recidivism rates. Therefore, the purpose of the current project is to conduct a case-control evaluation of the recidivism rates of male participants in the Brothers In Blue Program compared to a matched control sample. Quantitative analyses reveal that Brothers In Blue participants have lower recidivism rates than the control group. These results may inform future programming in other states and with women offenders.

**I Spy Prejudice: Individual Differences in Perceiving Disclaimers as Cues For Prejudice**

Daijah Jones, Stuart Miller, Tiffany Lawless, Donald Saucier

Department of Psychological Sciences

College of Arts and Sciences

Disclaimers such as “I’m not racist but..” are meant to convey an understanding that the statement that follows could be perceived as offensive, but is not intended to be so. However, individuals who have higher tendencies to perceive prejudice may see disclaimers as a sign that the speaker is racially prejudiced (Czopp, 2009). The purpose of our research is to examine how propensities to make attributions to prejudice (PMAPS; Miller & Saucier, 2018) and disclaimers interact to predict perceptions of racial statements. In a 2 (disclaimer/no disclaimer) x 3 (statement: prejudiced, ambiguous, benign) x continuous (level of PMAPS) mixed design, participants will rate the prejudice of the speaker and the statements, the speaker’s intent to express prejudice, and the degree to which they agree with the speaker. We hypothesize that higher levels of PMAPS will be related to perceiving disclaimers as a cue for prejudice even for benign statements. Although people may think that disclaimers indicate to others that they are not prejudiced they may ironically indicate they are prejudiced, especially to individuals who expect to see prejudice.

**Production and Purification of Aromatase for Co-crystallization with Potent Inhibitors  
AR11 and AR13**

Raul Leyva-Montes, Bryant Avila and Ho Leung Ng  
Department of Biochemistry and Molecular Biophysics  
College of Arts and Sciences

Aromatase (CYP19) is a cytochrome P450 enzyme responsible for catalyzing the conversion of androgens to estrogens. Inhibiting this enzyme is one approach to the treatment of breast cancer. Producing a 3-D crystal structure of aromatase is our lab's goal but is a challenging, and fundamental step in rationally designing new, potent inhibitors for the treatment of hormone-dependent breast cancer. Current antineoplastic therapeutics often produce unwanted patient side effects creating a need for the design of new, efficacious drugs. We produced functional CYP19 mutants L240S, G156A, and V80S for subsequent cocrystallization with our lab's two potent inhibitors AR11, and AR13. Protein production, column chromatography purification, and crystal screening techniques were applied in anticipations of crystal formation. We anticipate these mutants will increase the likelihood of producing protein crystals.

**Determination of Minimum Inhibitory Concentration (MIC) and Minimum Fungicidal Concentration (MFC) of Sodium Bisulfate and Lactic Acid against *Aspergillus Flavus* Found in Semi-moist Pet Food**

Luis Lopez, Janak Dhakal, Greg Aldrich  
Department of Grain Science and Industry  
College of Agriculture

Pet foods are traditionally dried to a moisture level below 10%, the purpose of this is to control possible mold growth. Semi-moist pet foods have a moisture of 20-30%. This greater percentage of moisture requires the incorporation of humectants and mold inhibitors. Sodium bisulfate(SBS)and lactic acid(LA) and other organic acids are often used for mold inhibition. The purpose of this project was to determine the minimum inhibitory concentration (MIC) and minimum fungicidal concentration (MFC) of SBS and LA against *Aspergillusflavusa* common mold found in semi-moist pet food. The MIC of SBS& LA against *A. flavus* were evaluated using a broth microdilution method in potato dextrose broth (PDB). A volume of 200  $\mu$ L of SBS or LA product solution consisting of twice the desired final concentration was dispensed in first well of a 96 wells plate (triplicate wells) and 100  $\mu$ L of sterile water in rest of the wells. A serial two-fold dilution of the organic acids was performed. One hundred microliters of mold culture (*Aspergillus flavus*) containing 6 logs CFU/mL (in PDB) wereadded to each well to make a final volume for 200 uL. A positive control consisted of mold inoculum only, and a negative control consisted of PDB without mold. The microtiter plate was incubated at 25°C for 48 h and visible growth in the wells was used to determine the MIC. The minimum fungicidal concentration was determined by plating the broth from microtiter plates on potato dextrose agar (PDA) and counting. The concentration which caused complete absence or <3 colonies of mold (99-99.5% kill) was considered the MFC. Results of the MIC and MFC study the addition of SBS and LA final results are pending.

**IPOs, Executive Compensation, and Firm Performance**

Nancy Lopez-Rodriguez, Ansley Chua

Department of Finance

College of Business Administration

Most businesses in the United States have had the chance to become public through initial public offerings, or IPOs. IPOs allow for some of the stock of a private company to be sold to the public. These IPOs generally bring in more capital to a business so the question of whether there is a specific determinant in executive compensation between males and females during these IPOs and if this has an impact on firm performance arises. The purpose of this research is to find if gender inequality pay exists in executive compensation during IPOs and if there is an impact on the performance of a firm. The age, gender, and ethnicities of over 1,240 executives of about 230 firms was hand collected mainly from EDGAR's (SEC's Electronic Data Gathering, Analysis, and Retrieval system) IPO prospectus filings. The sample of IPO's is from 2005 and 2010. With the data collected, the comparison of male and female executives' earnings is analyzed, and the performance of the businesses is seen through stock prices and failure or success of the company. The number of females serving as executives for each company was also taken into consideration. The results show that women executives make significantly less than their male counterparts when compared with similar executive positions. We can conclude that factors such as gender can affect executive compensation and that the number of female executives serves as a determinant in firm performance overall.

**Security definitions and syntax for AADL Lattice models**

Erick Martinez-Rosales and Eugene Vasserman

Computer Science Department

College of Engineering

The Architecture, Analysis, and Design Language (AADL) is primarily used for safety-critical systems as part of design, analysis, and realization phases. Many such systems are created with the primary purpose of functionality and safety, often forgetting security at the earliest stages, having to later retrofit or omit it altogether. After-the-fact security such as securing data at rest and in motion, and modeling per-component access control can be costly since it requires significant modifications to previously-analyzed and optimized systems. The purpose of this work is simplify the integration of security requirements during the system design phase. To accomplish this, we created a syntax to implement multi-level and multi-lateral security, typically represented as a lattice – a structure in which components, data, and information flows are categorized using labels as well as levels, allowing very fine-grained specification of data flow requirements and security clearances. We evaluate the approach by applying it to a previous work on an AADL-modeled GPS system, which originally used only the base syntax of AADL. Using our new approach, and integrating our work with the development of the ADDL Security Annex, we show how a modeling system previously designed only for safety systems can be extended to model and analyze advanced security properties as well, from the earliest stages of conceptualization and design to realization and configuration.

**Co-occurrence of Pathogenic and Avirulent Agrobacteria Within Individual Plants**

Veronica E. Mateo, Priscila Guzman, Thomas Platt

Division of Biology

College of Arts and Sciences

Plants are complex systems that house diverse microbial communities. These communities are important, in part, because they affect plant health. We aim to identify how often sunflower, *Helianthus annuus*, microbiomes harbor the plant pathogen *Agrobacterium tumefaciens* as well as avirulent agrobacteria. We hypothesize that avirulent and pathogenic agrobacteria will often co-occur such that competition is a common feature of this organism's ecology. *A. tumefaciens* infection involves genetic transformation of plant cells via the transfer of a small fragment of DNA located in the bacteria's tumor inducing (Ti) plasmid into the host genome. The expression of the virulence factors required for this is regulated by the VirA-VirG two component system in response to phenolic cues produced by plants. Following transformation, the plant's physiology changes to benefit the bacterial pathogen. The plant cells will divide rapidly, leading to the formation of tumors associated with crown gall disease. Transformed plant cells also produce metabolites that pathogenic strain can catabolize. We sampled 20 sunflower root samples, including three with visible root galls, from different locations within the Konza Prairie. We preserved 360 isolates from these plants so that we can characterize the phenotypic and genetic attributes of the agrobacteria present. We are using a  $P_{virB}::lacZ$  reporter system introduced to a random sample of isolates to evaluate how many of them are able to induce expression of this promoter, consistent with the presence of a VirA-VirG two component system. I will also evaluate the ability of these isolates to induce tumor formation on potato tissues.

**Low-Power Impact Detection in Composites**

Jared Medina, Jared Hobeck, Mathieu Rudloff, Matrin Frys, Tyler Albright, Khalid Abdelaziz  
Department of Mechanical and Nuclear Engineering  
Carl R. Ice College of Engineering

Different structures in the world are continuously under different stresses. Most of the stress or traumas do not leave any visible damage to these structures. Over time, structures can be liable to fail unexpectedly. To prevent disasters, devices that can detect these traumas are needed. The goal of this research is to develop an autonomous system to detect and store traumatic events. The data will be examined to determine the health of the structure. The system will work based on the piezoelectric effect. When certain materials are put under stress, a voltage proportional to that stress is created; the system will read out these voltages and store values that exceed a threshold. After a certain amount of counts is reached, the structure will be deemed too damaged for further use. A Texas Instruments microcontroller (MCU) MSP430G2553 was selected as the MCU because of its low power consumption. The MSP is connected to a piezoelectric (PZT) sensor that can measure changes in pressure, strain, or force by converting the qualities into an electrical charge. The MSP can read values between 0 V to 3.6 V. Voltages higher than this range were recorded so the MSP was connected to a voltage divider to divide the voltage by about 5. The PZT sensors are attached to a carbon fiber plate that is mounted onto a testing rig. A rod is dropped, and the resulting voltages are recorded. The fall of 2019 was spent learning the basics of hardware programming. Currently, the data acquisition method is being analyzed; it requires a lot of unnecessary data to be stored in order to extract the highest value. The code will be changed to record only the highest value found during an impact to reduce power consumption.

**Upscale of Graphene Oxide Using Novel Fenton Oxidation Method**

Azriel Minjarez-Almeida, Jose Covarrubias, Stefan H. Bossmann

Department of Chemistry  
College of Arts and Sciences

Graphene possesses multiple superior qualities such as electrical and thermal conductivity, mechanical strength, and optical transparency. The structure of single-layer graphene consists of a honeycomb, which often results in restacking and agglomeration. Once oxidized, graphene contains a highly oxygenated and hydrophilic layer that allows for stable dispersion in water. Through chemical reduction, graphene oxide can be converted back to graphene. Using a novel Fenton Oxidation method graphene oxide has been successfully synthesized at both small and large scales. Multiple small-scale trials were completed to establish the optimal ratio of solvent to solute. Characterization and upscaling conditions will be further discussed.

**Characterization of interactions among *Agrobacterium tumefaciens* strains from healthy and diseased sunflowers from across Kansas**

Emireth Monarrez, Veronica Mateo, Ashlee Herken, Thomas Platt

Division of Biology

College of Arts and Sciences

Agrobacteria are a diverse group of bacteria that are frequently associated with plant root microbiomes. Some members of this group can cause crown gall disease in a wide range of plant species, while others can cheat by accessing opines without paying the cost of pathogenesis. Both opine catabolic plasmids and Ti plasmids confer the ability to breakdown opines produced by infected plants. Our goal is to evaluate patterns of microbial interactions among strains of agrobacteria that co-occur within the microbiomes of common sunflowers. To do this, we first collected common sunflower, *Helianthus annuus*, root samples from Konza Prairie and used semi-selective media to obtain 10 – 40 biovar 1 agrobacteria isolates from each plant. We use a diagnostic physiological assay to validate candidate agrobacterial isolates prior to streak purification and preservation of the isolate strains. We are experimentally evaluating patterns of interference among isolates collected from the same plant. Further, to determine how common octopine catabolism is among these isolates we are developing diagnostic PCR for *ooxA* and *ooxB*, two genes known to be essential for octopine catabolism. A phenotypic assay will be used to evaluate if candidate octopine catabolic strains are able to breakdown octopine. Coupling this phenotypic data from a pathogenesis assay, will allow us to determine the frequency cheater and pathogenic agrobacteria in our sample of natural agrobacterial isolates from the microbiomes of healthy and infected plants.

**The Role of Malvolio in Ferrous Iron Transport in Insect Cells**

Diana G. Najera, Michelle E. Coca, and Maureen J. Gorman

Department of Biochemistry and Molecular Biophysics

College of Arts and Sciences

Iron is essential for all organisms including insects; however, at high levels it is toxic. Therefore, the transport and uptake of iron must be well-regulated, and in insects this process is poorly understood. Malvolio (Mvl), a protein integrated in the plasma membrane of the cell, is thought to be involved in the transport of ferrous iron. The goal of this study is to determine if Mvl from *Drosophila melanogaster* is involved in the uptake of iron into cells. Our experimental approach is to perform RNAi-mediated knockdown in cultured cells growing in standard medium. The cells treated with dsRNA that targets Mvl are expected to have less iron than the negative control cells. This result would support the hypothesis that Mvl is involved in the transport of iron into cells in *D. melanogaster*.

**Constructing a self-administration reward paradigm for a zebrafish (*Danio rerio*) brain model**

Jared Newell, Phillip Randall, Punit Prakash, Thomas Muller

Division of Biology

College of Arts and Sciences

Zebrafish is becoming an increasingly important model to study the neural mechanism of behavior and neurological disorders. Our lab aims to dissect the neural circuits that mediate reward-driven associative learning and goal-oriented, motivated behaviors which are compromised in affective disorders such as Schizophrenia and fear and anxiety disorders. In order to develop a behavioral paradigm that allows us to study this, it is important to construct the computational infrastructure. In this project, the construction of a food reward self-administration paradigm allows to study the neural circuits underlying motivated behavior and associative learning. Construction of such a chamber requires preliminary tests and trial software runs. Using IR sensors and a pump mechanism, fish will be rewarded food when they swim in one specific corner of the chamber. The self-administration reward paradigm relies on training the zebrafish to associate swimming in this corner of the tank with the release of a reward in the form of food. This model is referred to as a contingent paradigm, as it requires action on the animal's part in order to receive the reward. Contingent models have shown better neural results in previous experiments. This experimentation will allow the identification of neurophysiological processes underlying cognition, associative learning, and motivated behaviors. Subsequent data visualization and statistical analyses will require the programming of imaging software that allows monitoring and analysis of the animal's movement in the tank.

**Seeking release from Detention & Applying for asylum: An arduous process for Asylum Seekers**

Citlally Orozco and Alisa Garni

Department of Sociology, Anthropology, and Social Work

College of Arts and Sciences

Tens of thousands of asylum seekers from around the world are being held in U.S. detention facilities as they search for safety in the United States. In my study, I investigate the complex process people must navigate to seek release from detention and apply for asylum. The project was divided into two parts; in the first part, I analyzed scholarly literature to compare immigration policy and practice across the past two U.S. presidential administrations. In the second part, I explored shifts in immigration policy and practice by conducting in-depth interviews with professionals such as immigration attorneys, detention facility volunteers, an asylum seeker, and legal scholars. By analyzing various perspectives from people who engage with asylum policies, I was able to further understand how changing asylum policies impact asylum seekers, and particularly those who are being held in U.S. detention facilities. My findings suggest that changing policies affect asylum seekers directly by delaying asylum, making it harder to win an asylum case, and increasing the chances that people will be deported to deadly situations. I also learned about how changing asylum policies and practices make day-to-day survival harder for asylum seekers, and how new rules such as the Migrant Protection Protocols and the Asylum Ban make sure that as few people as possible are granted asylum. In my report, I detail the many ways in which seeking asylum is becoming more arduous. Through this research, I hope to shed light on the difficulties many asylum seekers face and generate ideas about how to improve the process.

**Does dietary quality moderate the effects of a ketogenic diet on cardio-metabolic and psychological outcomes?**

Gina Reyes, Catherine Steele, Sara Rosenkranz  
Department of Food, Nutrition, Dietetics and Health  
Physical Activity and Nutrition Clinical Research Consortium  
College of Health and Human Sciences

**Background:** Previous research shows the potential for a ketogenic diet (KD) to improve cardio-metabolic outcomes. However, the time required for adaptation to a KD is uncertain. A growing body of research suggests that dietary quality plays an important role in cardio-metabolic outcomes. Therefore, the purpose of this study is to determine the effectiveness of a KD for improving cardio-metabolic outcomes after one and four weeks in participants who consume a high-quality KD as compared to those who consume a low-quality KD.

**Methods:** Participants between the ages of 18–35 years (n=60) will be recruited to a three-arm parallel- group randomized controlled trial. The groups will include a high-quality KD, low-quality KD, and a non- KD control group (Westernized diet). Assessments at baseline, week one, and week four will include: body composition, resting metabolic rate, exercise efficiency, fasting plasma and urine-derived metabolic outcomes, and oral glucose tolerance. Additionally, psychological variables including mood, satiety, and cognition will be determined.

**Results:** Changes over time for all dependent variables and differences between diet conditions will be determined. We hypothesize that there will be no differences in cardio-metabolic outcomes between week one and week four when consuming a KD. However, we anticipate that there will be improvement in psychological variables at week four as compared to week one.

**Conclusion:** Results will provide insights regarding the time required for adaptation to a KD as well the importance of dietary quality for moderating the effects of a KD on cardio-metabolic and psychological outcomes.

**Vein Finder**

Dallas Rice–Steven and Steve Warren  
Department of Electrical and Computer Engineering  
Carl R. Ice College of Engineering

Warren Medical technology tends to be costly, which can be a challenge in under-resourced settings. The purpose of this research and development effort is to prototype a cost-effective vein finder that uses infrared light to illuminate vein patterns beneath the skin surface. This inexpensive, easy-to-use device will be portable and simple to duplicate. The first version of the system employs a raspberry pi single-board computer, which manages numerical computations and controls the infrared LEDs and the infrared camera. Part of the challenge involves integrating these inexpensive parts in such a way that the impact of the resulting images is maximized.

**Competing Capital Flows Influence on Quality of Governance and Corruption in Africa**

Bradley Richards, Michael Flynn

Department of Political Science

College of Arts and Sciences

Political and economic instability in African countries have negatively impacted economic development in these countries. To address these political and economic struggles, countries in Africa annually receive millions of dollars in foreign aid from various international entities. The foreign aid arena as it pertains to the African continent has traditionally been dominated by the Organization of Economic Co-operation and Development (OECD) countries. However, over the last three decades, China has emerged as one of the leading countries to show interest in investing in Africa. The Chinese government has done this through non-traditional foreign aid loan distribution, primarily investing in infrastructure, transportation, telecommunication, and energy projects. The main difference between traditional and nontraditional aid donors is that nontraditional aid donors generally do not place conditionalities on their loans. The Chinese government refrains from government interference when providing aid in African countries, whereas the OECD implements loan conditionalities that facilitate policy outcomes where local preferences are at odds with general welfare like anti-discrimination or human rights violations. Previous research has suggested a positive relationship between foreign aid and corruption. With increasing alternative capital flows in African countries, this research project is a comparative study designed to test the effect of Chinese and OECD loans on the domestic politics of recipient countries to understand how competing capital flows influence quality of governance and corruption in African countries.

**Using Machine learning to predict the “emotions” throughout different parts of the brain.**

Jacob Rico-Martinez and Dave Thomson

Department of Electrical Engineering

Carl R. Ice College of Engineering

In the past few years there has been a lot of investment in biomedical engineering and technology. One of the most used research systems is the EEG cap and a more innovating term called transfer learning. The EEG cap is an electroencephalogram test that detects electrical activity in the brain using metal discs or electrodes that are attached to the scalp. Transfer learning is the process of having one machine or model to learn a specific task from a previous model. We are combining this technique to speed up the process of detecting emotions. In this research we are learning what “emotions” the user is feeling in different parts of the brain. The different parts of the brain are activated using a different stimulus such as pictures, sounds, and videos. The goal is to use machine learning to predict the emotions the user will feel in different parts of the brain. We will achieve this by collecting data using the EEG cap and analyze recordings to see what the user feels in a specific area of the brain. Then, by using the data collected through images we can use transfer learning to have the computer predict what the user feels when put though other stimulus such as sounds and videos. This would be a great use of transfer learning in the biomedical field since it will reduce the amount of programming and preparations to detect certain emotions produced by different stimulus. This system would prove useful in different mental therapies or just simply in trying to learn more about the human brain. This would create a new and more effective way to detect emotions using different systems and learning processes.

**Detection of Acute Myeloid/Lymphoblastic Leukemia Using Artificial Intelligence**

Citlali Rocha and Ho-Leung Ng

Department of Biochemistry and Molecular Biophysics

College of Arts and Sciences

Leukemia continues to be one of the most death inducing cancer types in the world. It is a form of cancer that attacks the blood, bone marrow, and lymphatic system. Using machine learning techniques, such as image processing, we are able to detect the cancerous blood cells quicker by using a machine. Image processing is an overall phrase for functions that analyze images or convert an image to another. A program that would allow a machine to use image processing to detect two specific types of Leukemia, which are Acute Lymphoblastic Leukemia (ALL) and Acute Myeloid Leukemia (AML), would be created. First, a program code was written and uploaded on to Google Collab. Next, a dataset was uploaded to that code to have it running. The dataset consisted of several pictures of blood cells with changes in their morphological characteristics. The machine is taught to show the condition of a cell to be normal or abnormal. So far, using two different machines and running two trials on each, there is an average accuracy of 93.75%. Overall, we expect it to perform excellently and to obtain close to or a 100% accuracy. From the testing that has been done, it has been fairly close. This study is necessary because doctors usually recognize the cancerous blood cells under a microscope, but it requires time to do so correctly when patients need to know as soon as possible. With this study, we are able to accomplish the earlier and easier detection of Leukemia.

**A\*\* Kicking and Care Taking: Masculine Honor Beliefs and Individuals' Priorities in Socializing Children**

Julia Romo, Ashley Schiffer, Tiffany Lawless, Amanda Martens, Tucker Jones, Donald Saucier  
Department of Psychological Sciences  
College of Arts and Sciences

Masculine Honor Beliefs (MHB) contend men's aggression is justifiable in response to provocation or in protection of others (Saucier et al., 2016). What has yet to be studied is how MHB are taught to individuals, so we created a program of research examining the relationship between MHB and the socialization of children. In Study 1, participants rated the importance of teaching various lessons to their children based on lessons identified previously in a qualitative study. We hypothesized a positive relationship between MHB and perceiving it as important to socialize sons to defend themselves and daughters to care for others. Our hypothesis was confirmed in teaching sons more than daughters to learn to defend themselves; however, there was no difference in importance of teaching sons versus daughters to care for others. In Study 2, participants rated which parent in a heterosexual, nuclear family should have the primary role in teaching various lessons to both sons and daughters, namely defending oneself and caring for others. We hypothesized that individuals with greater adherence to MHB would think fathers should teach sons more than daughters to defend themselves, and mothers should teach daughters more than sons to care for others. Consistent with our hypothesis, as MHB increased, so did the expectation that the father should teach children how to defend themselves, especially sons, and the mother should teach children, especially daughters, how to care for others. Overall, these studies help us better understand how MHB are passed down to future generations and by whom.

**Solid State Nanostructured Graphene Based Supercapacitors**

Esvin Ruiz, Suprem Das and Anand Prakash

Department of Industrial and Manufacturing Systems Engineering

Carl R. Ice College of Engineering

Electrochemical double layer capacitors (EDLC) also known as supercapacitors are energy storage devices, capable of producing a very high-power density. They are promising for several practical applications and grid level electrical energy storage in the future. In the supercapacitors charge is stored electrostatically by forming a double layer in the close proximity of solid electrode surface and electrolyte, thus allowing ultra-fast charging and discharging rate. The unique charging mechanism rendered an extended active operational cyclability. Thus, the supercapacitor could be the better alternative of conventional electrical energy storage devices which apparently suffer from poor cyclability, longer charging time, and lower power density. The quantity of charge stored in a supercapacitor depends on the accessible surface area of the electrode; thus, nano structured materials are preferred for the electrode material due to high surface to volume ratio. The two-dimensional graphene, a honeycomb lattice of the carbon, is a unique material due to its high electrical conductivity and highest surface area making graphene one the best electrode material for supercapacitors. Thus, we fabricate a solid-state supercapacitor using nanostructured graphene. The electrodes are prepared by coating graphene slurry (a semiliquid mixture) on the metal current collector (Aluminum foil) forming a film. The supercapacitor device was fabricated by vertically stacking two electrodes separated by the ionic gel electrolyte. The specific capacity of the fabricated device was measured in the charge-discharge cycle and found  $\sim 100$  F/g. Using supercapacitors is more efficient and will allow us in the future to store more energy and replace our current energy storing methods.

**Assessment of Medial Gastrocnemius Mechanical Properties and Postural Stability**

Serrano EF, Pacinelli LE, Williams JA, Vardiman JP, Thiele

Department of Food, Nutrition, Dietetics and Health

College of Health and Human Sciences

Recently, myotonometry (MYO) has been shown to be a valid and reliable tool for evaluating musculotendinous mechanical characteristics (tone, stiffness, etc.) of the lower limb. However, few studies have examined the relationship between the isolated viscoelastic characteristics of the medial gastrocnemius (MG) and functional performance. Thus, the aim of this investigation is to determine the influence of creep (CR) and stress relaxation time (RT) on postural balance performance. Ten healthy, males (mean  $\pm$  SD: age =  $20.7 \pm 1$  year, mass =  $165.6 \pm 29.38$  lbs, height =  $175.75 \pm 8.26$  cm) participated in a cross-sectional correlation study. The participant's right ankle was maintained at  $90^\circ$  (neutral position) and the probe of the myotonometric device was positioned over the belly of the MG. Postural stability was assessed on a commercially-designed balance device in which participants performed 3, 20-s dynamic balance trials of the right leg with a progressive platform spring resistance. Overall stability index (OSI) and anterior-posterior index (API) were calculated from each trial. Significant, strong negative correlations were observed between the MG CR and RT with API ( $r = -0.704, -0.699$ ;  $p$ -value =  $0.023, 0.025$ ). Results demonstrate that improved balance performance, specifically anterior-posterior stability, may be associated with increased CR and RT of the MG. Thus, the viscoelastic characteristics of the MG may be a contributor to the ability of maintaining a stable position. Therefore, various musculotendinous mechanical adaptations occurring to the lower limb through training/rehabilitation, injury, or aging may greatly influence functional performance.

**Design of Sensors for in-vivo Detection of Caspase Activity**

Laura Soto, Jose Covarrubias, Stefan H. Bossmann

Department of Chemistry  
College of Arts and Sciences

Cancer continues to be among the leading causes of death worldwide. In 2018, in the United States alone, there were 1.7 million new cancer cases and over 600,000 deaths.

Therefore, there is an urgency to find better alternatives to battle cancer. Studies have shown that caspases are a group of proteases that play an essential role in programmed cell death. However, the evasion of cell death is considered one of the hallmarks of cancer. That is why, the goal of this project is to create a nanobiosensor, which would have Magnetic Resonance Imaging-based capabilities to measure enzymatic activity in-situ by monitoring the T1 and T2 relaxation times of cancerous and non-cancerous tissue. This diagnostic tool would be useful to differentiate between benign and malignant tumors in-vivo and to quantify the effects of cancer treatments, such as chemo- and radiation- therapy. The biosensor is composed of a small (2-3 nm) Fe<sub>2</sub>O<sub>3</sub> nanoparticle, which is a good T1 contrast agent, and a large (~50 nm) magnetic Fe/Fe<sub>3</sub>O<sub>4</sub> core/shell nanoparticle, which is a good T2 contrast agent. Both nanoparticles will be linked via a consensus caspase sequence.

**Ways to Limit Injuries in Young Teens**

Briana Thompson and Phillip Vardiman

Department of Food, Nutrition, Dietetics and Health

College of Health and Human Sciences

Athletic trainers are healthcare professionals that are trained to provide care for athletes. They are most common in professional or collegiate settings due to the increase in prevalence and intensity of workouts. With the increase of club youth sports and schools, some school districts are having to consider hiring an athletic trainer. The purpose of this research is to see if athletic trainers are beneficial in a high school setting. To see if athletic trainers are beneficial in a high school setting, a part-time athletic trainer was hired to a high school that previously did not have one. The presence of an athletic trainer was compared to when there were only coaches and nurses who treated athletes. I will use this research and perform my own at my hometown middle school. Studies showed that a decrease in injury prevalence did not occur. In my own experiment, I expect the results to support my claim. In the presence of athletic trainers, injury reports will be more accurate and athletes will be able to seek early treatment before major injuries occur. The presence of athletic trainers will hopefully prevent the increasing amount of overuse and overstretch injuries seen in today's athletes. Due to their ability to spot injuries early on and treat them, athletic trainers are beneficial in high schools.

## **The Relationship Between Migration and Urbanization in Vietnam**

Vu H. Vo, Bimal Paul, Shawn Hutchinson

Department of Geography and Geospatial Science

College of Arts and Sciences

Vietnam is one of the countries in the world that has low-income, and abundant young physical laborers. It is beneficial for Vietnam to absorb the foreign investment with more than 23% in the country (2015). This is the reason for rural migration to the urban areas which is rapidly developing since the early 21th century. In the last two decades, Vietnam has been urbanizing as a result of rapid economic growth, and 54% of the country's population currently lives in cities (2015). Urbanization is transforming Vietnam's economy and society as well as its urban and rural landscapes. Migration of rural residents, particularly young people to cities in search of better employment and educational opportunities, is the important driver of the recent urbanization. This study tries to interpret how rapidly urbanization takes place in Vietnam and analyze the relationship among population, migration, growth rate, and how they are distributed across the country. To answer those questions, the information was collected from public articles, books, and magazines to make a big frame background and understand the topic. Data was from Vietnam's General Statistical Office and DIVA-GIS websites. By using ArcMap and R program to create the following map and graphs from collected data. As the result, there is a strongly positive relationship between urban population and growth rate in urban regions. The in-migration also explains high concentration of population density in urban regions which drives and increases the investment in urban regions. From this study, one can understand the relationship between urbanization and movement of population across the country.

**What Culpability Do We Have in State Executions of Queer People?**

Derrius Washington, Rachel Levitt

Department of Gender, Women, and Sexuality Studies

College of Arts & Sciences

In this project, I asked: given the widespread international criminal persecution of gay relationships what culpability do U.S. businesses, faith organizations, and consumers have in supporting some of the most egregious forms of state violence against queer people? To answer this question, I focused on one country's legal battles aimed at making homosexuality punishable with the death penalty. I studied the case of Uganda's Bill 18, what has commonly become known as their "Kill the Gays" law and tracked the various discourses used to justify its passage. I also investigated the funding streams that helped support the passage of the law. Ultimately, my research revealed the ongoing impacts financial support for homophobic state persecutions have and the need for us as consumers to hold businesses accountable.

**Learning Effects in Older Adults for Tests of Physical Function**

Brooke Crawford and Katie Heinrich

Department of Kinesiology

College of Health and Human Sciences

Older adults perform various activities of daily living (ADL) such as standing up from a chair or climbing stairs. The extent to which they can do ADL determines how independent they are (Cumming et al., 2000). Physical function measures the performance of these tasks (Chou et al., 2012). Learning effects occur when participants get better at the test instead of the fitness aspects which are being tested (Wood et al., 2001). Performing multiple baseline measures can help control for learning effects during data collection. Is there a learning effect for older adults between first and second baseline physical function movement assessments? When comparing two baseline assessments for 8 older adults there were significant improvements in the Timed Up & Go ( $p = 0.005$ ) and the Stair Climb Test ( $p < .001$ ). This suggests that these tests have learning effects and should be controlled for in research studies to maximize effects.

**The Lesser of Two Evils: Masculine Honor Beliefs, Beliefs in Pure Good, and Beliefs in Pure Evil and their influence on moral decision-making**

Elizabeth Hohn, Dr. Saucier, Ashley Schiffer  
Department of Psychological Sciences  
College of Arts & Sciences

Decision-making is difficult even in everyday situations--and in life-or-death situations, decisions have far greater consequences. Research suggests the utilitarian approach applies particularly well in moral dilemmas that take place in wartime settings where casualties are common (Brandt, 1972). Utilitarianism aims to maximize good and minimize damage for the largest number of people (Mill, 1895). In a study of 269 participants, we investigated Masculine Honor Beliefs (MHB), Beliefs in Pure Good (BPG), Beliefs in Pure Evil (BPE), and their influence on decision-making in hypothetical life-or-death situations that take place in both military and non-military settings. We also evaluated participants' feelings about their decisions, including their confidence and guilt. Specifically, we predicted that higher levels of these three individual difference measures would be associated with increased utilitarian decisions. We speculated that those with strong MHBs would be more willing to use aggression to protect others and those with strong BPG would want to promote good by saving more lives. Similarly, we expected strong BPE would accept sacrifice as necessary to prevent further evil from happening. Contrary to our hypotheses, these individual differences did not predict utilitarian decision-making. Consistent with our hypotheses, MHB and BPE were positively correlated with confidence in decision-making and BPG with guilt. Also, consistent with past research, we predicted more utilitarian responses would be made in military scenarios than in non-military scenarios; however, this hypothesis was not supported. These studies provide insight as to how individuals make morally challenging decisions in times of war and peace.

**Kyle Kramer**  
**Manhattan High School**

---

**Creating Sub-Nanometer SWCNTs Using Trace Amount of Ruthenium**

Kyle D. Kramer, Dr. Placidus B. Amama, Aaron Porter, Tim Taylor  
Department of Chemical Engineering, Kansas State University  
Carl R. Ice College of Engineering

We report the generalized conclusion made from studies involving modified catalysts of Fe and Co each tested with the addition of Ru on Al<sub>2</sub>O<sub>3</sub> substrates (Al<sub>2</sub>O<sub>3</sub>/Fe/Ru) (Al<sub>2</sub>O<sub>3</sub>/Co/Ru) with the goal of creating sub-nanometer carbon nanotube (CNT) carpets. The modified catalysts are deposited using an ion beam sputter/etcher (IBS/e) and grown via chemical vapor deposition (CVD). It was found that sub-nanometer CNT carpets were supported on the catalysts of both Fe and Co. Upon further inspection it was confirmed that single walled CNTs (SWCNT) were present in abundance. In addition the length of the SWCNTs does not seem to be affected by the addition of Ru in either catalyst. It must be stated that the exact specifications of the experiments done will not be mentioned due to reasons of confidentiality. It seems that the addition of small amounts of Ru in the catalyst composition decreases the size of atom clusters of its counterpart in the catalyst (Fe or Co). Beyond this the interaction between the Fe and Ru/Co and Ru catalysts raises questions about the atomic structure of the said catalyst atom clusters post-annealing. This work provides new insight into element interactions on the atomic level and how this can be used to continue to decrease the size of grown SWCNT carpets while maintaining a standard length.

**The effects of different thermal environments on the detection efficiency of lithium foil  
neutron detectors**

Matthew Culbertson and Dr. Douglas McGregor  
Department of Mechanical and Nuclear Engineering  
Carl R. Ice College of Engineering

Special nuclear materials (SNM) are neutron emitting materials that can be used in radiological weapons that threaten the security of the planet. The ability to detect these materials is highly coveted by governments across the globe. The benchmark neutron detector is the He-3 neutron detector, however, recently there has been a shortage of He-3 sparking interest in finding an alternate detector. One of the alternative options is the Li-6 Foil detector which has demonstrated it is a capable alternative in ideal lab conditions. To test this detector in alternate thermal environments, peltier chips will be used in tandem with water cooled heat sinks and vapor chambers to effectively and evenly change the temperature of the detector in order to measure how its detection efficiency is affected by its local thermal environment. If the change in efficiency is too large, this would limit where and when the detectors can be used without additional thermal controls that could affect the detector's efficiency.

**Intraspecific variation in tall grass big bluestem *Andropogon gerardii* populations across a precipitation gradient of the Central US grasslands: Response to experimental drought**

Megan Keenan, Paige Wiebe, Jake Alsdurf, Matt Galliard, Loretta Johnson  
Division of Biology  
College of Arts & Sciences

Evolutionary ecology seeks to understand factors that contribute to population genetic divergence, and formation of ecotypes. Habitats are often spatially variable, causing different selection pressures. *Andropogon gerardii*, dominant grass of the Great Plains, is used on five million acres of restoration and accounts for \$8 million in cattle production. We characterized intraspecific variation between populations of *A. gerardii* from different rainfall regions and assessed population response to drought. Because populations experience strong selection from rainfall, we hypothesize 1) trait differences should be due to rainfall of population origin, 2) dry populations should be more drought-tolerant, and 3) population differences should be supported by underlying genetics. Nine populations spanning rainfall 437-1020 mm annually (CO to IL) were planted into 1.2L pots in greenhouse for six months. Droughted plants received 200mL water every three days, while controls received daily water. We report on vegetative morphology, above and belowground biomass, physiology (water potential, SPAD) and underlying genetics. There is clear evidence for strong population differences depending on rainfall and lesser effects of experimental drought. Wet populations had significantly longer and thicker leaves, and produced more above and belowground biomass. When wet populations were exposed to drought, leaves were disproportionately narrower, above and belowground biomass reduced, and had less favorable water balance; all indicating greater sensitivity to drought. Intraspecific variation was corroborated by genetic differences with greatest genetic distances between CO and IL populations. Combined, results suggest that populations of *A. gerardii* have different growth strategies, with populations from the west limited by water, and populations from the east limited by light and competition. Finally, intraspecific differences should be considered in climate-matching populations for restoration across the Great Plains.

**CRISPR-Based Modification of *Caenorhabditis elegans* microRNA**

Mira Bhandari, Dr. Anna Zinovyeva, Shilpa Hebbar

Division of Biology

College of Arts and Sciences

MicroRNAs (miRNAs) are ~22 nucleotide long, non-coding RNA molecules that silence RNA and regulate post-transcriptional gene expression. Therefore, miRNAs are important “managers” of protein production. Because miRNAs are potent regulators of gene activity, identifying the developmental processes in which miRNAs are involved is imperative. Since the role of *mir-787* miRNA in the development of an organism is unknown, deleting the *mir-787* locus can create a null strain which will allow us to investigate its function. In this study, the CRISPR-Cas9 genome editing technique was used to engineer a *mir-787* deletion in the model organism *Caenorhabditis elegans*. PCR screening was used to confirm deletions in the injected worms and their progeny.

**Alison Payne**  
**Manhattan High School**

---

**Effects of Habitat Fragmentation: A Test of the Habitat Amount Hypothesis**

Alison Payne and Kimberly With  
Division of Biology  
College of Arts & Sciences

The ecological field of literature is filled with studies that highlight the importance of both habitat loss and habitat fragmentation on biodiversity, although the two are often confounded with one another. Recently, the Habitat Amount Hypothesis proposed that patch size and patch isolation effects on species richness could be reduced to a single gradient: the total amount of habitat, meaning habitat fragmentation does not affect species richness. This study uses an experimental landscape system that adjusts for the level of fragmentation independently of habitat area to study arthropod species richness in clumped versus fragmented landscapes. Overall, fragmentation had little to no effect on species richness, only exhibiting an interaction at the start of the study. Thus our results uphold the Habitat Amount Hypothesis, though the idea that fragmentation has no effect may be an oversimplification.

**Can social reasoning abilities be predicted from personality and individual differences?  
Emotional Intelligence, Trust, Honesty/humility, and theory of mind as potential predictors**

Anya Wesely and Gary Brase  
Department of Psychological Sciences  
College of Arts & Sciences

Human reasoning has traditionally been conceived as an abstract process, however recent research has found significant relationships between particular (social) reasoning contexts and relevant personality traits. These individual differences have been used to try to understand the nature of human reasoning, whether it is content independent or dependent. These “content dependent” reasoning effects were studied using a large sample (n=334) and multiple personality measures. Specifically, reasoning about social contracts, precautions, and non-social situations were evaluated concurrently with measures of emotional intelligence, interpersonal/intimate trust, honesty/humility, and theory of mind abilities. The study results replicated previous findings of reasoning performance differences based on content area, with better performance on social exchange and precautionary scenarios. The results also replicated recent findings in terms of different Theory of Mind measures lacking cohesion in their results. Further analyses will evaluate the relationships between the reasoning performances and the personality differences, both in terms of simple correlations and with multiple regression analyses. These findings will inform current debate about the nature of human social reasoning, specifically between the “mental models” theory of reasoning and evolutionary theory of reasoning, and also can be useful for understanding real-world issues in interpersonal communication.

**What is the biochemical mechanism that causes sweating to occur in Ixodidae ticks?**

Alex Andresen and Dr. Yoonseong Park  
Department of Entomology  
College of Agriculture

The family of hard ticks, *Ixodidae*, sweat through cuticle dermal cells in response to heat and mechanical disturbances. If the full biochemical response that causes sweating was understood, there is potential a synthesized chemical could stimulate sweating in ticks, leading to dehydration and death in tick populations. A study done by Park et al. focused on finding the cellular mechanisms that caused sweating to occur. Past studies have found that *Ixodidae* salivary tissue contains  $\text{Na}^+/\text{k}^+$  ATPase protein pumps and potentially uses them to move fluids. The hypothesis is that ticks have  $\text{Na}^+/\text{k}^+$  ATPase protein pumps in cuticle dermal pores and use them to create an osmotic pressure difference between epidermal tissue and their environment, resulting in sweating. To isolate the tissue, the cells were embedded in paraffin and cut using a microtome into 3-5 micrometers. After isolating the dermal pore tissue, the proteins were tagged with fluorescent antibodies through the process of immunohistochemistry (IHC). The current methodology used to isolate the tissue has been shown to damage the tissue before the IHC was conducted, leading to inconclusive results in regard to the location of the protein pumps. New methods are currently being looked into that could increase the tissue's integrity, thereby potentially leading to more significant results in the IHC phase.