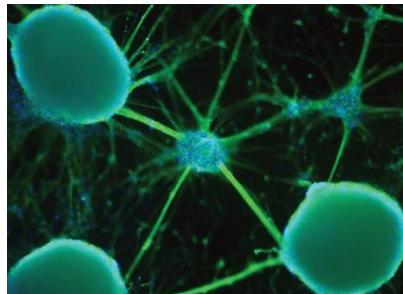
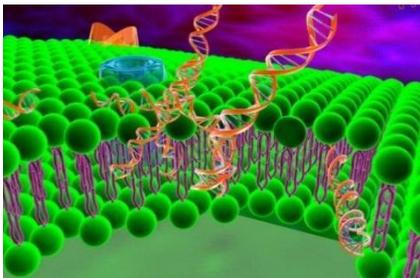


# Iowa State University



## 13<sup>th</sup> SYMPOSIUM ON UNDERGRADUATE RESEARCH & CREATIVE EXPRESSION

April 17, 2019

<http://www.undergradresearch.iastate.edu/symposium/>

# Program Overview

**8:00 – 9:00**    **REGISTRATION AND BREAKFAST**, Memorial Union, Pioneer Room

**9:00 – 9:20**    **OPENING**, Memorial Union, Gallery Room

**Welcome: Dr. Svitlana Zbarska**, Undergraduate Research Program Coordinator

**Opening remarks: Dr. Guru Rao**, Associate Vice President for Research

**9:30 – 10:45**    **SESSION I** (*concurrent presentations*)

**I.A – Animal Science**

Memorial Union, Gallery Room

**I.B – Political Science and Spanish**

Memorial Union, Room 3534

**I.C – History and Economics**

Memorial Union, Room 3558

**I.D – Computer and Software Engineering**

Memorial Union, Room 3505

**I.E – Architecture**

Memorial Union, Oak Room

**I.F – Biochemistry**

Memorial Union, Cardinal Room

**I.G – Microbiology & Genetics**

Memorial Union, Room 3512

**10:45 – 11:00**    **Break & Refreshments**, Memorial Union, Pioneer Room

**11:00 – 12:00**    **SESSION II** (*concurrent presentations*)

**II.A – Biosystems Engineering**

Memorial Union, Cardinal Room

**II.B – Physics**

Memorial Union, Room 3505

**II.C – Sociology**

Memorial Union, Gallery Room

**II.D – Community and Regional Planning**

Memorial Union, Room 3512

**II.E – Entomology**

Memorial Union, Room 3558

**II.F – Kinesiology and Health**

Memorial Union, Oak Room

**II.G – Environmental Studies**

Memorial Union, Room 3534

**II.H – Psychology and Mass Communication**

Memorial Union, Gold Room

**12:00 – 1:00**    **Lunch**, Memorial Union, Sun Room

**Key speaker presentation: “Life Lessons From a Circuitous Career”, Dr. James Oliver**, Director of the ISU Student Innovation Center, professor at the Department of Mechanical Engineering, Iowa State University

- 1:00 – 2:15**    **SESSION III** (*concurrent presentations*)
- III.A – Materials Engineering**  
Memorial Union, Room 3534
  - III.B – Mechanical Engineering**  
Memorial Union, Oak Room
  - III.C – Psychology**  
Memorial Union, Cardinal Room
  - III.D – Electrical Engineering**  
Memorial Union, Room 3505
  - III.E – Civil Engineering**  
Memorial Union, Room 3558
  - III.F – Kinesiology and Health**  
Memorial Union, Room 3512
  - III.G – Microbiology**  
Memorial Union, Gold Room
  - III.H – Environmental Science**  
Memorial Union, Gallery Room

**2:15 – 2:30**    **Break & Refreshments**, Memorial Union, Pioneer Room

- 2:30 – 3:30**    **SESSION IV** (*concurrent presentations*)
- IV.A – Chemistry**  
Memorial Union, Cardinal Room
  - IV.B – Aerospace and Mechanical Engineering**  
Memorial Union, Gallery Room
  - IV.C – Food Science and Human Nutrition**  
Memorial Union, Oak Room
  - IV.D – Genetics and Microbiology**  
Memorial Union, Room 3512
  - IV.E – Agronomy and Environmental Science**  
Memorial Union, Room 3558
  - IV.F – Political Science and Mass Communication**  
Memorial Union, Gold Room
  - IV.G – Biology and Animal Ecology**  
Memorial Union, Room 3534
  - IV.H – Industrial Engineering and Design**  
Memorial Union, Room 3505

**3:00 – 5:00**    **POSTER SESSION**, Memorial Union, Great Hall

*Each presentation is allotted 15 minutes. Participants and guests are asked to not enter or leave the rooms during presentations.*

## **A Message from the Undergraduate Research Program**

Welcome to the Iowa State University's 13th Annual Symposium on Undergraduate Research & Creative Expression. The Symposium provides undergraduates from all academic disciplines with an opportunity to share their research with the university community and other guests through oral and poster presentations. Near 190 students from all Iowa State University colleges will present about 130 research projects. More than 50 Iowa State faculty members will participate as faculty moderators to provide feedback to presenters. More than 80 student volunteers from the University Honors Program will assist in running the symposium. The Symposium represents part of a large effort of Iowa State University to enhance, support and celebrate undergraduate research activity.

The students selected for this year's Symposium and their mentors represent all the Colleges at Iowa State University: Agricultural & Life Sciences, Business, Design, Engineering, Human Sciences, Liberal Arts & Sciences and, Graduate and Veterinary Medicine.

We hope you enjoy the day!

**Svitlana Zbarska**

Symposium Coordinator

ISU Undergraduate Research program coordinator campus-wide

# SESSION I, 9:30 – 10:45 am

Session I.A  
9:30 – 10:45  
Gallery Room

## ANIMAL SCIENCE

**Faculty Moderator:** Joshua Selsby, Animal Science

I.A.1 **Effect Of Two Dietary Copper Treatments On Implant Performance Response And Carcass Characteristics Of Finishing Beef Steers**

**Presenter:** Summer Castillo, Animal Science

**Mentor:** Stephanie Hansen, Animal Science

**Abstract:** Hormonal implants are used to increase feed efficiency, better growth rate and increased amount of muscle deposition. Implants are used regularly in the animal agriculture industry. The role of copper in growth is through the copper dependent enzyme lysyl oxidase, which is responsible for cross-linking of collagen and elastin in the extracellular matrix. Which means that depending on copper concentration in the body there can be a better response to the hormone implants. This study looks at varying copper levels in sixty Angus crossbred steers and how their copper status affected their response to hormone implants. The steers were assigned to groups receiving either an industry treatment for amount of copper added to the diet or a control treatment where there was no supplemental copper added to their diet. Each group was divided into an implant group or a no implant group. It was hypothesized that liver copper concentrations would influence the growth response caused by the implant. There tended to be an implant and copper interaction in which the control caused a greater live average daily gain response to implant than the industry treatment. These results suggest dietary copper concentrations may impact growth response in implanted steers. Investigating the mineral requirements for high growth animals could help in the future use of implants so producers can create a supplementation program that caters to the animal's needs.

I.A.2 **In Situ Fiber Digestibility of Soybean Meal and DDGS Pelleted with Corn Stover Compared to Pelleted Corn Gluten Feed for Dairy Cows**

**Presenter:** Miranda Clausen, Animal Science

**Mentor:** Hugo Ramirez-Ramirez, Dairy Nutrition

**Abstract:** Feed is the most expensive input for milk production, and current market conditions are leading dairy producers and nutritionists to look for more economical alternatives for feed. One alternative to lower the cost of a ration is to include byproducts such as corn gluten feed (CGF), soybean meal (SBM), and distillers grains (DDGS). Furthermore, crop residue such as corn stover could also be included in dairy rations. Although corn stover is not very nutritious, a combination of corn stover with byproducts could improve its nutritional value. The objective of this study was to determine the fiber content and in-situ kinetics of ruminal digestibility of three pellets formulations: corn stover + SBM, corn stover + DDGS, and corn gluten feed. Samples of each formulation were incubated in the rumen of 2 rumen-cannulated dairy cows for 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, and 24 h. Acid (ADF) and neutral (NDF) detergent fiber were determined for each formulation and time point. Data were analyzed using a statistical software (SAS). Content of NDF was 29.5, 37.7 and 44.5% (dry matter basis) for CGF, corn stover + SBM, corn stover + DDGS, respectively. Digestibility of dry matter at 24 h of rumen fermentation was 11.1% greater ( $P < 0.01$ ) for the formulation with SBM; CGF and corn stover + DDGS had similar dry matter digestibility. Similarly, digestibility of ADF and NDF was greatest ( $P < 0.01$ ) for the SBM formulation followed by DDGS, whereas CGF had the lowest fiber digestibility. Even though corn stover + SBM pellets are more digestible than CGF and DDGS at 24 h, a longer fermentation period is warranted to evaluate the full extent of digestion. It was observed that the samples were quite variable, it is recommended to test each batch before diet formulation.

I.A.3 **The Effects of Dietary Protein Oxidation on Growing Pigs**

**Presenter:** Erika Johnson, Animal Science

**Mentor:** Mariana Rossoni-Serao, Animal Science

**Abstract:** In today's livestock diets rendered by-products are common feedstuff. Due to the exposure of high temperatures during processing and storing, it can potentially become oxidized. Dietary protein oxidation can affect oxidative stress in livestock species which reduces the efficiency of production animals. This area of nutrition has limited research about the effects of dietary protein oxidation and on how it may induce oxidative

stress on livestock species. The objective of this study was determining if dietary oxidized proteins can induce oxidative stress. To begin this study, 30 pigs that were 6 weeks of age were separated into three dietary treatments that were control, medium, and high dietary oxidized protein. Each of the treatments had a different amount of the degree of oxidation of the bovine plasma which was at 10 percent, everything else was held constant. Each of the pigs were fed for 19 days and then euthanized to collect tissues samples. The organs that were collected were the jejunum, liver, and colon along with urine and plasma samples were collected on day 0 and 18. Tests that were run on jejunum samples to test the oxidative stress from the dietary proteins were protein carbonyl, thiobarbituric acid reactive substance (TBARS), 8-hydroxyguanine, and glutathione peroxidase activity. The pigs in the high oxidation treatment showed significant difference in the average daily gain and intake while there were trends observed in crypt depth and DNA damage. This study concluded that oxidative stress of the animal was effected by dietary oxidized proteins.

Session I.B  
9:30 – 10:45  
Room 3534

## POLITICAL SCIENCE

**Faculty Moderator: Mack Shelley, Political Science**

### I.B.1 **Blackness in Latin America: Current Racial Discourse and the Role of the Census**

**Presenter:** *Nayely Hurtado*, Political Science, Spanish

**Mentor:** Elisa Rizo, World Languages & Cultures

**Abstract:** The purpose of this study is to explore discussions of race in Latin America and analyze how societal views and governmental action has impacted the Afro-Latin American population in Colombia, Mexico, Peru, and Cuba. Various sources were used to understand the climate for Afro-Latin Americans, including scholarly publications and census data from English or Hispanic sources. The researchers found that Afro-Latin Americans are often less educated and occupy a lower socioeconomic status than their counterparts who do not hold the same racial makeup. Inequalities facing Afro-Latin communities and individuals are hard to counter systematically due to Latin American nations largely undercounting or not counting Black populations in their national census. Undercounting is also due to a lack of consensus on how to define Blackness by the state and Afro-Latin American organizations, as well as individuals not identifying as black because of bias. Overall, the study found that Afro-Latin Americans face significant inequality and erasure in society, the census has proved to be an important point for activism, and the concept that Latin American populations are equally mixed has shaped racial discourse. Latin American race concepts can be essential to further research on race and colorism in other countries and societies.

### I.B.2 **Tracking Second Language Phonetic Learning in Spontaneous Speech**

**Presenter:** *Shelby Bruun*, Spanish and International Studies

**Mentor:** Charles Nagle, World Languages and Cultures

**Abstract:** According to the Speech Learning Model (Flege, 1995), L2 sounds that are similar to native language sounds are challenging because adult learners will equate them, leading to an accented production in the L2. One of the core tenets of the model is that learners can improve their production over time as they become more experienced L2 speakers. However, there are relatively few studies focusing on the development of L2 sounds during the initial stages of L2 learning. Investigating the individual differences that emerge during this period could explain variation in long-term L2 pronunciation attainment. Addressing this gap in the literature, the current study examined how first-year learners of L2 Spanish produce Spanish voiceless stop consonants /p t k/ over time (e.g., the [p] in pagar, 'to pay'). English stops are aspirated, or produced with a strong burst of air (e.g., say "pepper" with your hand directly in front of your mouth), but Spanish stops are not, making them an ideal candidate for cross-linguistic phonetic study.

This project leveraged a longitudinal data set that was collected from 30 native English speakers over their first two semesters of Spanish language study. At each session, participants completed a series of picture descriptions that were designed to elicit spontaneous speech in Spanish. For the current analysis, data points coinciding with the beginning and end of the first semester and the end of the second semester were selected for analysis, resulting in a final sample of 16 participants. Burst duration on voiceless stops was marked and measured using Praat acoustic analysis software. Preliminary analyses suggest that participants struggled to reduce the burst on L2 /t/, but they produced a far shorter (i.e., more Spanish-like) burst on L2 /p/. These results suggest the influence of phonological patterning on the accuracy of L2 speech production over time.

## HISTORY AND ECONOMICS

**Faculty Moderator: Diane Janvrin, Accounting**

I.C.1 **Measuring Farm Size in the United States, 1959-2012**

**Presenter:** *Skylar Schneekloth*, Economics and History

**Mentor:** Peter Orazem, Economics

**Abstract:** Following the model of the Gini coefficient and Stigler's (1958) survival principle, this paper develops a useful measure of farm size that combines two conventional statistics (reported sales and acreage). Our measure reflects the entire distribution of farm sizes rather than relying on point measurements such as the mean or median value, which have remained constant since 1975 according to the United States Department of Agriculture. This paper initially offers a simple graphic illustrating dynamic changes in the market; it is essentially a story of competition between small and large farms. Based on the graphic, we use basic calculus to derive the Share-weighted Size Index which is our proposed measure for farm size. We consider the Share-weighted Size Index superior to conventional measures of farm size such as the mean or median. Relying on the Share-weighted Size Index to measure farm size, we document substantial variation in the timing and magnitude of increasing farm sizes across time, across field-crop, and across U.S. regions. We then use regression analysis to estimate the Share-weighted Size Index and find that farm size generally decreases in opportunity costs, a result at odds with Kislev and Peterson (1982).

I.C.2 **Carrie Chapman Catt: Contextualizing Controversy**

**Presenter:** *Crystal Brandenburgh*, History

**Mentor:** Stacy Cordery, History

**Abstract:** On 18 August 1920, National American Woman Suffrage Association (NAWSA) President Carrie Chapman Catt realized her lifelong goal with the ratification of the Nineteenth Amendment to the U.S. Constitution. Since 1848, suffragists had been working and fighting to win the vote, but it was Catt's "Winning Plan" that ultimately resulted in victory. Her triumph was called into question in 1995 after her alma mater, Iowa State University, named a building in her honor. Students and faculty claimed that Catt's rhetoric during and after the suffrage battle was racist. Almost a quarter of a century later, Carrie Chapman Catt Hall continues to incite unrest, letters to the editor, and protests from the campus community—and the collective unhappiness rests upon one sentence written by Catt. Historians have focused more on her influential role in the movement, rather than her rhetoric much because she has been overshadowed by the founding generation of woman suffragists. My research paper, "Carrie Chapman Catt: A Politician of Her Time," analyzes little-known examples of Catt's speeches and writings, investigates the levels and degrees of her racism, and provides historical context for her words. This research is important for understanding the way in which attitudes and beliefs from the past affect the present and it gives insight into the role of race in the modern social climate. Based on archival primary source research into Catt's work, rhetoric, and image, this paper provides a basis for further study into modern conceptions of racism and the intersection between race and women's history.

I.C.3 **Erwin Panofsky's Iconography in the Interpretation of The Sixth Patriarch Chopping Bamboo**

**Presenter:** *Jiu Cao*, Visual Culture Study

**Mentor:** John Cunnally, Visual Culture Study

**Abstract:** Erwin Panofsky was one of the most influential art historians of the twentieth century. In his *Studies in Iconography* in 1939 he proposed a scientific method to interpret the various levels of meaning found in a work of art. His method has been very successful and remains important in the field of Art History today. While studying the Panofsky system, I became curious to learn if this method would still be successful when analyzing a painting from the Far East instead of a Western one. The Sixth Patriarch Chopping Bamboo is one of the most renowned Chan (Zen) paintings by the artist Liang Kai of the South Song Dynasty (1127-1279). Chan means "meditation" and is one of the sects of Buddhism which focus on inward communion. The practice of Chan strongly relates to the overall ideology of the Chinese and Japanese cultures, and Liang Kai's painting is one of the best examples of this ideology. My research makes use of the Panofsky system to interpret step by step The

Sixth Patriarch Chopping Bamboo, showing both the advantages and the disadvantages of Panofsky's method when applied to Far Eastern art.

Session I.D  
9:30 – 10:45  
Room 3505

## COMPUTER AND SOFTWARE ENGINEERING

**Faculty Moderator: Aleksandar Dogandzic, Electrical Engineering and Computer Science**

### I.D.1 **Investigating and Modeling a Network of Embedded Systems**

**Presenter:** *Modeste Kenne*, Computer Engineering

**Mentor:** Phillip Jones, Electrical and Computer Engineering

**Abstract:** The Internet of Things (IoT) corresponds to our growing network of intelligent physical devices, such as home appliances or home monitoring systems that have the capacity to share data, resources, and react in the face of environmental changes. As a society, we share an increasing desire to connect our smart objects to even smarter ones so that they communicate with each other for the sake of conserving energy, keeping our homes safer, saving time and money, or simply for entertainment, convenience, and comfort. However, with the IoT's constant connectivity and sharing of sensitive data, we create greater safety and security threats for ourselves as users. In this project, we examine how embedded system devices can be better managed to identify security, connectivity, privacy or other major issues, in the modeling of such networks. Knowledge gained will be used to design a secure prototype consisting of a small number of embedded devices and a platform that serves as both a managing and debugging tool for household networks.

### I.D.2 **Let The Device Talk**

**Presenter:** *Yealim Sung*, Software Engineering

**Mentor:** Mai Zheng, Electrical and computer Engineering

**Abstract:** New OS systems have both upsides and downsides. Whereas the upside comes with higher performance, issues do arise when integrating with former systems. As a disruptive technology, flash devices and software modules must co-exist within the traditional ecosystem, one that is already complicated and difficult to get right. Due to this, people often make the incorrect assumption that the error is in the behavior of SSDs, when oftentimes it is from the kernel itself. The difficulty in diagnosing such failures further complicates these systems, as developers change kernel and device settings in the hope of finding a solution. This research designs DevAgent - where instead of the typical top-down, indirect approach to diagnosing storage failures, it does it in bottom-up direct approach. We use the host-device interface, as it is simple and straight-forward compared to system internals and is suitable for narrowing down the root causes of failure. DevAgent will intercept the commands at the interface dynamically and integrate with the traditional top-down diagnosis techniques. There will be two versions; DevAgent-sw and DevAgent-fw, the first command intercepts the commands in a device driver, and the latter extends QEMU-based SSD emulators to support an unmodified software stack.

Session I.E  
9:30 – 10:45  
Oak Room

## ARCHITECTURE

**Faculty Moderator: Andrea Wheeler, Architecture**

### I.E.1 **Creating E-Footprints: A Case Study In Creating Virtual Space For Environmental Learning**

**Presenter:** *Evan Harrison*, Architecture

**Mentor:** Alenka Poplin, Community and Regional Planning

**Abstract:** In the advent of drastic climatic changes, the narrative about reducing individual energy consumption is becoming increasingly more relevant; this is especially true in resource-vulnerable communities, where increased heating and cooling costs are especially impactful. Recognizing the learning curve that individuals face in reducing their own energy consumption, this research presentation chronicles the design and development of an online-learning game (titled E-footprints) created by the ISU Sustainable Cities Team which aims to teach gamers about low-cost methods for reducing home energy consumption. Specifically, this presentation delves into the methodology of designing contextualized online environments for players to situate themselves within; a workflow that integrates neighborhood housing research, 3D modeling, and

gamification features to increase impact and relatability to game participants. Moreover, this study concludes by asking what additional factors and methods could be leveraged to advance the context of virtual environments, and their effectiveness of participant learning.

#### I.E.2 **Entertainment Spaces 2.0**

**Presenter:** *Shivang Patel*, Architecture

**Mentor:** Lynn Paxson, Architecture

**Abstract:** The history of athletic entertainment spaces can be traced back to the earliest civilizations. It is quite amazing how these spaces have changed over the years around the world and most importantly the change in audiences' interests and interaction with such places. The term entertainment includes spaces from ancient Colosseum to modern-day arenas and stadiums. These places are the main sites of community togetherness and entertainment. However, many communities are unable to experience this togetherness for a large part of the year as these spaces are not accessible most of the time – they are just used for few days in a year. Hence, this research attempts to learn the reasons why these mega-structures are underused. The research involves an initial investigation into analyzing global historical and modern precedents to understand the function of such spaces and engaging in designing new strategies and creating new affordances to produce multi-functional spaces that can be utilized for a greater portion of the year. We have in the past, and we are investing large amount of our wealth into these spaces and hence, it is important to utilize them to their best. This research will provide a basis for continuing research and questions regarding some best practices of community involvement in the design of spaces, especially spaces that explore the possibilities of joint public and private ownership and management. This research can help to create a foundation for the next generation (2.0) of entertainment spaces.

#### I.E.3 **Museum of Islamic Art in Qatar by Pei: Tradition and Modernization in Islamic Architecture**

**Presenter:** *Rami Mannan*, Architecture

**Mentor:** Jelena Bogdanovic, Architecture

**Abstract:** The Museum of Islamic Art (MIA), designed by I.M.PeI and located in Doha, Qatar, is selected as it perhaps marks the critical point in the continual development of Islamic architecture. The intention of this paper is to discuss and develop ways at which to quantify and measure the successfulness of the attempts made to continue the development of Islamic Architecture within its modern context. As the developing Middle Eastern nations expand and explore modernization, Islamic Architecture develops alongside modernization while continuing to serve its own Islamic cultural context. A paradox arises between the traditional building typologies in Islamic architecture and the museum building typology as part of the changing typologies of the modern urban fabric. In particular, I will be looking at the modern museum as a building typology as part of Doha's new feat towards modern urbanism and becoming the cultural capital of the middle east and its implications within a Muslim society. Finally, I analyze the museum's architecture in attempt to create a framework that would be used to critiques its ability to advance the continuation of Islamic Architecture; in regards to its ability to embody the virtues of Islam while fulfilling its societal and contextual obligations as a museum.

Session I.F

9:30 – 10:45

Cardinal Room

## BIOCHEMISTRY

**Faculty Moderator: Stone Chen, Biochemistry**

#### I.F.1 **Determinants of Membrane Association in the Synaptic GTPase-Activating Protein SynGAP**

**Presenter:** *Sarah Zelle*, Biochemistry and Genetics

**Mentor:** Eric Underbakke, Biochemistry

**Abstract:** SynGAP is an abundant post-synaptic density (PSD) GTPase-activating protein critical to brain development, long-term potentiation, and spatial learning. Despite its ubiquity and central signaling role, the architecture and signaling mechanisms of SynGAP remain largely unknown. SynGAP regulates both Ras and Rap, GTPases controlling opposing outcomes for synaptic plasticity. The specificity determinants of SynGAP toward Ras and Rap remain unclear. Ras and Rap cycle between the cytosol and membrane, and intriguingly SynGAP exhibits putative membrane localization domains. We hypothesize that the PSD membrane influences the recognition of Ras and Rap by SynGAP.

Previous work in the Underbakke lab established in vitro assays for SynGAP activity. To explore the role of the plasma membrane on SynGAP activity, we first tested binding of SynGAP to membrane vesicles using vesicle sedimentation assays. We designed liposomes to match the biological composition of the inner leaflet of the membrane, where Ras and Rap are known to bind. We did the groundwork to ensure that binding came to an equilibrium and ultracentrifugation reproducibly separated liposomes from soluble fraction. Domain deletions demonstrated that SynGAP C2 domain mediates membrane association.

In parallel, we considered the membrane localization of Ras, which is post-translationally modified in the cell and anchored into the plasma membrane. To mimic the biologically-relevant lipid anchoring of Ras, cysteine reactive N-octadecylmaleimide was synthesized. The same liposome sedimentation assay technique was then used to anchor the Ras construct into the membrane. After separating soluble protein from membranes using ultracentrifugation, Ras was found to be stably associated with the membranes. In the future, this will also be done using Rap.

Our next step will be to employ activity assays to monitor the regulatory function of SynGAP in the membrane. Using membrane-localized Ras and Rap, we will be able to examine SynGAP activity in a uniquely biologically-relevant context.

#### I.F.2 **Understanding the Binding Affinity of Neutrophil Gelatinase-Associated Lipocalin with DNA Aptamer**

**Presenter:** *Sam Coder*, Biochemistry

**Mentor:** Marit Nilsen-Hamilton, Biochemistry, Biophysics and Molecular Biology

**Abstract:** Acute Kidney Illness (AKI) is a condition in which the kidneys fail to filter fluid and diagnosis requires lengthy tests. In attempt to reduce the time to diagnose, a designed DNA aptamer is bound to the Neutrophil Gelatinase-Associated Lipocalin (NGAL) protein. The NGAL protein is excreted in excess in patients whom are diagnosed with AKI. To fully understand how the NGAL protein is interacting with the aptamer on a molecular scale, the site at which the two are linked must be investigated. Positive amino acids, which bind to the negative DNA aptamer, are targeted by site-directed mutagenesis and transformed into XL1-Blue supercompetent cells. The mutated protein must be grown by expressing its sequence in *E. coli* and lysing the cells, releasing the protein. Once the purified protein has been obtained, the specificity of the aptamer with the protein is tested, thus determining the binding site between the two.

#### I.F.3 **Response of different length of LCN2 promoter to LPS.**

**Presenter:** *Hiroki Hasebe*, Biochemistry

**Mentor:** Marit Nilsen-Hamilton, Biochemistry, Biophysics and Molecular Biology

**Abstract:** NGAL protein, the product of the LCN2 gene is known to be expressed upon inflammation inside the cells. NGAL protein is known to have several functions and one of them is as a siderphone binding protein that binds to bacterial ferric siderphones and limited the bacterial effect. Not all the NGAL protein function is clarified. However, they tend to be expressed when organs are experiencing the inflammation. One of the features that makes NGAL so interesting is, when it is expressed due to inflammation deep inside the body they remain the longest compared to other inflammatory gene expression products, which has a great potential to be used to identify subclinical inflammation at the organs leading to acute failure. In this project, I am studying the expression of the different length of LCN2 promoter to conduct a basic research on the factors affecting the NGAL promoter expressions and also to find differences of expressions inside the different types of the cells. The method used is Dual Luciferase analysis, and promoter length used is wt (-264bp) long promoter (-1690bp) and mutated promoter (-264mm) and they are transfected into the MCF-7 cells to see its gene expression under the LPS solution to simulate the inflammation. Wt promoter known to have basal binding sites, but the longer promoter seems to express with higher signal. The investigation is further extended to different cell lines in future. Studying of the promoter of LCN2 gene could contribute to the future research of the use of NGAL as a biosensor to identify subclinical inflammation inside the body to avoid acute organ failure, in future.

Session I.G  
9:30 – 10:45  
Room 3512

## MICROBIOLOGY AND GENETICS

**Faculty Moderator:** *Aubrey Mendonca*, Food Science and Human Nutrition

#### I.G.1 **Autophagy Importance in Podocyte Homeostasis in *Drosophila***

**Presenter:** *Rachel Mehmert*, Biology

**Mentor:** Hua Bai, Genetics Development and Cell Biology

**Abstract:** The highly conserved autophagy process that delivers long-lived organelles and proteins to the lysosome for degradation has been identified as a contributor to homeostasis maintenance among kidney podocytes. Recently, podocyte injury has been identified as a leading factor of glomerular disease and renal failure. This research examines whether disruptive autophagy impairs kidney function by determining the mechanism for tissue-specific constitutive autophagy regulation in model organism the fruit fly. A GABARAP immunostaining approach is used to identify the roles of the mechanistic target of rapamycin (mTOR) complex 2 (mTORC2) in regulating autophagosome production in podocytes. Preliminary results suggest that mTORC2 is a positive regulator of autophagy and when it is inhibited, constitutive autophagic activity is impaired in podocytes. These findings indicate the importance of constitutive autophagy in maintaining podocyte integrity, proposing a target to ameliorate aging-related glomerular disease in human renal function.

I.G.2 **Analysis of the P97 and P102 Gene Families in Mycoplasma Hypopneumoniae Isolates**

**Presenter:** *Morgan Smith*, Software Engineering and Microbiology

**Mentors:** Iddo Friedberg, Chris Minion, Veterinary Microbiology and Preventive Medicine

**Abstract:** Mycoplasma hypopneumoniae, a pathogenic bacteria in swine that infects the respiratory tract, is the primary cause of enzootic pneumonia and has detrimental economic effects on the pig industry. Mycoplasmas lack a cell-wall and have a small, A+T rich genome of approximately 1 Mbp. Previous studies have highlighted the significance of the P97 and P102 gene families which influence the ability of M. hypopneumoniae to adhere to swine cilia and may be a target for future vaccine development. The P97 and P102 genes each have 6 paralogs and are generally co-located across the genome. In this study, we developed a pipeline to assemble the genomes of 16 M. hypopneumoniae field isolates using Next Generation Sequencing data from Illumina, MINion, and Ion Torrent sequencers in paired-read and hybrid assemblies with Unicycler. Further analysis allowed us to compare P97, P102, and their paralogs and determine variability amongst these genes, and understand the connection between evolution and functionality.

I.G.3 **Examining The Functional Role Of MicroRNAs Implicated In Hypermobility Ehlers-Danlos Syndrome In Maintaining Connective Tissue Morphology**

**Presenter:** *Scarlett Eagle*, Genetics

**Mentor:** Elizabeth McNeill, Food Science and Human Nutrition

**Abstract:** Ehlers-Danlos Syndrome (EDS) is a family of genetic connective tissue disorders characterized by mutations affecting the production and processing of collagens and related proteins. The cause of the most common type, Hypermobility EDS (hEDS), is still unknown.

MicroRNAs (miRNAs) are a class of small non-coding RNAs that function in gene silencing and post-transcriptional regulation of gene expression. There are over 2,500 human miRNAs, which are collectively predicted to regulate over 1/3 of human genes. miRNAs exhibit intricate tissue- and stage-specific regulation of gene expression, making them a promising candidate for investigating the underlying causes and treatment of complex genetic disorders.

The broad variation between patients, along with factors such as gender disparities and developmental implications, makes the possibility of microRNA dysregulation as a cause of hEDS promising.

Drosophila melanogaster is a great model organism to study miRNA functions in disease in vivo because of their short life spans, their high conservation to human genes, and the myriad of tools available to facilitate genetic studies.

Using predicted miRNA-mRNA interactions from published transcriptome-wide expression profiling data from hEDS patients, we identified the dysregulated human miRNAs that were conserved in Drosophila as well as the fly homologs of their predicted target genes. After identifying potentially-pathogenic interactions, we were able to manipulate miRNA levels to mimic those of patients in an attempt to model hEDS in fruit flies.

Examination of collagen fibril morphology in flies modeling microRNA dysregulation patterns identified in Hypermobility Ehlers-Danlos Syndrome will begin to elucidate the possible functional role of miRNAs in this genetic disease.

# SESSION II, 11:00 am – 12:00 pm

Session II.A  
11:00 – 12:00  
Cardinal Room

## BIOSYSTEMS ENGINEERING

Faculty Moderator: Jacek Koziel, Agricultural and Biosystems Engineering

### II.A.1 Effects of Hydraulic Residence Time on Water Quality in Woodchip Bioreactors

**Presenter:** Kyle Werning, Biosystems Engineering

**Mentor:** Michelle Soupir, Agricultural and Biosystems Engineering

**Abstract:** Fertilizer use and high soil organic nitrogen levels in the Upper Midwest have led to high levels of nitrate in drainage and surface water; drinking water treatment plants must then spend increase spending for nitrate removal before public consumption. Bioreactors, which are trenches filled with wood chips, are a viable option as an edge-of-agricultural-field practice designed to reduce nitrate levels in drainage water. Research at Iowa State University's Agricultural Engineering Research Farm tested nine woodchip bioreactors for four years to evaluate how water retention time changed bioreactor viability. Wood chips from six of the reactors were extracted at the end of the study and are being tested for total carbon remaining and the particle size distribution, along with nitrate levels (measured over four years) in the water after flowing through the woodchips. These tests provide information on how long wood chips in a bioreactor will last. Higher moisture percentages were observed at the top level of the bioreactors which can affect the denitrification amounts because of an increased amount of available water to be able to denitrify. Woodchip bioreactors are efficient in reducing the amount of nitrate that flows into surface water, leading to less contamination of Iowa's drinking water.

### II.A.2 Examining Implications of Climate Change for Food Security in the U.S. Midwest: A Geospatial Analytics Approach

**Presenter:** Angie Burke, Biosystems Engineering

**Mentor:** U. Sunday Tim, Agricultural and Biosystem Engineering

**Abstract:** Food security depends in part on agricultural production, which relies heavily on the nation's land, water, and other natural resources. The 2018 Fourth National Climate Assessment report indicates that climate variation and climate-induced events, such as extreme heat or drought and heavy downpours, can negatively impact agricultural production. Such disruption might be caused by agricultural region shifting also known as shifting cultivation. This shift in crop production zones pose significant threats to agricultural regions like the U.S. Midwest. Using integrated geospatial modeling and ArcGIS, a spatial query software, our study examines potential impacts of climate changes and variations on crop production on the regional scale. We expect that crop production zones will need to shift to locations with similar ideal climate conditions. This study provides an improved understanding of the implications of climate variability and change for crop distribution and production in the U.S. Midwest, reducing threats of food insecurity at regional and global scales.

### II.A.3 UV Light Treatment of Barn Inlet Air to Mitigate PRRS Transmission

**Presenter:** Peiyang Li, Biosystems Engineering and Environmental Science

**Mentor:** Jacek Koziel, Agricultural and Biosystems Engineering

**Abstract:** My research project focuses on improving biosecurity of animal production by eliminating the spread of Porcine Reproductive and Respiratory Syndrome (PRRS) airborne virus, the most destructive disease affecting the swine industry in the U.S. and especially in Iowa (#1 swine-producing state). A novel approach to treat PRRS is to use ultraviolet light to inactivate the virus and prevent it from spreading from farm-to-farm. This project represents the initial phase of designing and building an apparatus for the mitigation of PRRS transmission with UV light treatment of barn inlet air at the proof-of- concept stage. Three UV lights, black light UV-A, "excimer" UV-C (207-222 nm), and conventional UV (254 nm) will be tested for their germicidal effectiveness in terms of contact time, light intensity, electric power input, and other practical considerations for on-farm use to eliminate PRRS virus. For UV-A and UV-C, the evaluation will also be based upon their feasibility for barn inlet air treatment in pilot scale. It is significant that the economic analysis will be conducted to prove the advantage of UV light treatment (including cost savings) over currently used HEPA filtration.

II.B.1 **Exploring New Source Classification Methods in Infrared Astronomy with Machine Learning**

**Presenter:** *Jacqueline Blaum*, Physics and Computer Science

**Mentor:** Rafael Martinez-Galarza, Smithsonian Astrophysical Observatory, Harvard-Smithsonian Center for Astrophysics

**Abstract:** Knowledge of the infrared (IR) sky is crucial for understanding astrophysical phenomena including star formation and the late stages in the evolution of intermediate- to high-mass stars. It also provides a large potential for discovery, because many sources detected in IR surveys such as protostars, evolved dusty stars, and young stars bearing biogenic ices in their circumstellar environments have not been fully characterized. To maximize the scientific potential of IR surveys, we must be able to classify sources that often overlap in color-color diagrams. Here we aim to produce an improved census of IR sources in the galactic plane by employing machine learning (ML) techniques rather than traditional color cuts to source classification, which allows us to assign probabilistic rather than deterministic labels. Specifically, we aim to increase the number of young stellar objects such as biogenic ice candidates, which are particularly important to the study of planet formation and constitute excellent targets for follow-up with missions like the recently approved NASA Medium Explorer mission SPHEREx. We have constructed a robust training set of spectroscopically confirmed sources and used their photometry to train three ML classifiers: Support Vector Machine, Random Forest, and Multi-layer Perceptron. When classifying a test set, all three optimal classifiers perform with F1 scores  $>0.97$ . We apply the optimal Random Forest algorithm to a target set of WISE- and Gaia-selected sources in the galactic plane. So far, we have classified over 60,000 of these sources, among which we find over 1,000 likely biogenic ice candidates. We are continuing to expand our training set in order to apply these techniques to larger sets of unclassified sources.

II.B.2 **Particle Hole Symmetry Breaking in Cuprate Superconductors**

**Presenter:** *Daniel Russell*, Physics

**Mentor:** Adam Kaminski, Physics

**Abstract:** It has long been assumed that all superconducting materials should exhibit particle-hole symmetry. We use ultra-high resolution, VUV laser-based, Angle Resolved Photoemission Spectroscopy (ARPES) to examine Momentum Distribution Curves (MDCs) taken along nodal cuts (0,0) to  $(\pi,\pi)$  of Bi<sub>2</sub>Sr<sub>2</sub>CaCu<sub>2</sub>O<sub>8+ $\delta$</sub>  (Bi2212) and B<sub>2</sub>Sr<sub>2</sub>CuO<sub>6+ $\delta$</sub>  (Bi2201) to observe particle-hole symmetry breaking of thermally excited electrons near the Fermi energy. This symmetry breaking is linked to an asymmetry between the real and imaginary parts ( $\Sigma'$  and  $\Sigma''$  respectively) of the self energy  $\Sigma$  in the spectral weight function, corresponding to an increased scattering rate, decreased lifetime, and a change in energy of the excited states. We find the symmetry breaking to be temperature dependent, with the effect increasing as temperature decreases, and we find this effect to be present and consistent throughout the cuprates. Currently we have no theoretical explanation, so this effect needs to be fully understood and explored in other materials before a microscopic theory of High Temperature Superconductivity can be obtained.

II.C.1 **Law And Policies Regarding Stepfamily Relationships: A Patchwork Quilt**

**Presenter:** *Elcy Timothy*, Sociology and Political Science

**Mentor:** Susan Stewart, Sociology

**Abstract:** Stepfamilies are a common family form in the United States. About 40% of new marriages are remarriages and two-thirds of remarriages include children from previous relationships. About three-quarters of U.S. children whose parents' unions dissolve will acquire a stepparent. Overall, 42% of all Americans report having at least one step-relative. Despite the prevalence of stepfamilies in the U.S., they have few institutional supports and existing laws and policies (or the lack thereof) currently work against healthy stepfamily

relationships. This research provides a current description and analysis of laws, policies, and regulations concerning stepfamilies. Results show that laws and policies continue to privilege legal marriage and blood ties, whereas stepparents and stepchildren remain “legal strangers” to one another, with few rights and responsibilities. The result is that for stepfamilies everyday living can be fraught with difficulties especially in their dealings with other social institutions. Stepfamilies are forced to navigate a “patchwork quilt” of conflicting laws and policies with respect to education, healthcare, and social welfare programs. For example, our federal immigration system considers stepfamily members “immediate relatives” but military benefits are not extended to stepchildren. This research concludes with recommendations for changes to family policies that would better meet the needs of stepfamilies.

#### II.C.2 **An In-Progress Look at the State of Sexual Violence Knowledge on Iowa State’s Campus**

**Presenter:** *Emily Hammer*, Marketing and Management

**Mentor:** Alissa Stoehr, Sociology

**Abstract:** As Iowa State works to promote an environment of wellbeing and safety for its students, there have been trainings and studies administered campus-wide, such as Title IX training and the Campus Climate Survey. In an effort to determine the most deficient areas of sexual violence knowledge on Iowa State’s campus specifically, this project is in the process of administering and analyzing a survey that is specifically written to gauge said knowledge. This project seeks to define these deficiencies both qualitatively and quantitatively with questions derived from larger scale sexual violence surveys from other universities that offered more broad analyses. This project will serve as a benchmark for Iowa State administration to understand what areas of knowledge need to be the subject of more training for students and where the university can improve as a whole as they work to make campus an even more welcoming place for all. Because this project is still in the process of being administered and analyzed, results will still be preliminary at the time of the presentation.

#### II.C.3 **Utilizing the Push-Pull Theory to Explore Green Event Attendees’ Motivations**

**Presenter:** *Yu Ye*, Event Management

**Mentor:** Ching-Hui Su, Apparel, Events, and Hospitality Management

**Abstract:** As sustainability has become a pressing global issue, consumer awareness of environmentalism has increased. While many scholarly consumer research has been conducted concerning environmental behavior, consumer motivations and behavioral intentions towards environmentally sustainable-themed events in the meetings, expositions, events, and conventions (MEEC) industry is an under-explored area in current hospitality, tourism, and event literature, despite the growing “green trend.”

This study aims to identify the influential factors that motivate US residents to attend to sustainable-themed events (green events). The objective of the study is to explore event attendees’ motivational factors toward green events and intentions to attend an event engaged a sustainable practice/element. To achieve the objectives, we will obtain data (N = 1,000) from a cross-national, web-based survey distributed to consumers between 18-65 years of age living in the continental US. The questionnaire was comprised of five multi-item summated rating scales adapted from previously used scales cited in a review of related research literature: (1) environmentalism importance; (2) green event attraction push/pull factors; (3) values; (4) retention; and (5) sociodemographic information (e.g., age, gender, and annual income) to measure green event visitors’ motivational factors. Data analysis will be performed by using the Statistical Package for the Social Sciences (SPSS) Version 23.0. The results will give event professionals, marketers, and academicians’ insight to understand attendee’s motivation and thus develop effective marketing and planning strategies.

#### II.C.4 **Predicting Shifts In Iowa Farmers’ Climate Change Beliefs And Attitudes Toward Climate Action Over Time**

**Presenter:** *Sara Ronnkvist*, Statistics

**Mentor:** J. Gordon Arbuckle, Jr, Sociology

**Abstract:** Climate change, one of the most urgent societal challenges, is negatively impacting Iowa and U.S. agriculture, and over time may threaten global food security and societal stability. On October 8, 2018, the International Panel on Climate Change released a Special Report on Global Warming. The report states that action to increase the resiliency of agricultural systems and reduce agriculture’s greenhouse gas emissions through more sustainable agricultural practices is urgently needed (see link). The research project will address the human dimensions of this critical challenge. The Iowa Farm and Rural Life Poll, a long-term panel survey of Iowa Farmers, in recent years has asked questions about farmers’ climate change awareness and willingness and capacity to undertake key adaptation and mitigation actions. The research project will examine factors that

influence Iowa farmers' climate change beliefs, attitudes, willingness, and capacity to take proactive measures to adapt to climate change as well as reduce greenhouse gas emissions. This research will employ multivariate statistical analyses to examine the factors that influence climate change beliefs, and how, in turn, those beliefs are associated with perceived risks and willingness to take action in response to climate change. We posit that experience of extreme weather events will shift climate change belief structures, which will influence attitudes toward action in three categories – individual adaptation to climate change, agricultural stakeholder adaptation to climate change, and government action to limit greenhouse gas emissions. The results of this timely study will inform outreach and extension programs for farmers as well as policy approaches.

Session II.D  
11:00 – 12:00  
Cardinal Room

## COMMUNITY AND REGIONAL PLANNING

**Faculty Moderator: Ted Grevstad-Nordbrock, Community and Regional Planning**

### II.D.1 **The Case for Car-Free Communities**

**Presenters:** *Zoey Mauck*, Landscape Architecture and Community and Regional Planning

**Mentor:** Ben Shirtcliff, Design

**Abstract:** Air pollution, obesity, traffic fatalities, poverty, accessibility, and overall human happiness might seem to be entirely separate issues, but there is one thing that sits at the root of them all: the car. Our world has become consumed, and in turn congested, with single-passenger vehicles that affect each of these issues. Some issues (traffic fatalities) might seem more obvious than others (human happiness), but in the end, all deserve equal attention when considering how straightforward the solution could be: creating car-free communities. By exploring the many reasons for and benefits generated by going car-free, providing examples of communities that have been successful in making this change already, and analyzing a small town, Perry, Iowa, with great potential to go car-free as a case study, this analysis aims to reveal how challenges can be overcome to achieve success in creating human-centered, healthy, equitable, and livable communities.

### II.D.2 **Examination of Economic Resilience and Regional Capacity in the Midwest**

**Presenter:** *Stuart Burzette*, Community and Regional Planning and Environmental Science

**Mentor:** Monica Haddad, Community and Regional Planning

**Abstract:** Micropolitan areas are between small towns and large cities, with a population over 10,000 and under 50,000 people. U.S. includes a total of 576 Micropolitan areas which comprises 10% of the national population. While Micropolitan areas include a significant part of the US population, they have been neglected from academic research. Their importance should not be neglected, as Micropolitan areas have the promising potential to fulfill the needs of the migrants who are moving out of small towns and/or out of metropolitan areas and prefer the life style of medium size cities. The dearth of research on Micropolitan areas is especially problematic when their existence is threatened by economic shocks which can happen, for instance, when a major employer decides to leave a region. This research will answer the following question: What are the economic characteristics that make certain counties with Micropolitan areas more resilient than others? In this research, we will test the following hypothesis: counties with Micropolitan areas that lost establishments with 250 employees or more and still experienced employment growth between 2008 and 2016 are considered economically resilient counties. Our methodology will use regression models to understand the relationship between employment growth and counties' economic characteristics such as related entropy, dependence on agriculture, and percentage of employment in manufacturing. The economic shock will be measured by the difference in establishments with 250 or more employees in 2008 and 2016. Socio-economic characteristics such as change in percent poverty, change in percent vacant housing units, and distance from Metropolitan areas will be included in the models as control variables. Results will allow us to deliver recommendations for Micropolitan areas' planners who are interested in designing strategies to increase economic resiliency.

Session II.E  
11:00 – 12:00  
Room 3558

## ENTOMOLOGY

**Faculty Moderator: Sue Blodgett, Entomology**

### II.E.1 **Stress Related Protein Expression in Honeybees**

**Presenter:** *Roslyn Gray*, Biology and Women's and Gender Studies

**Mentor:** Amy Toth, Ecology, Evolution, and Organismal Biology

**Abstract:** Bees are important ecological and agricultural insect pollinators. According to the United States Department of Agriculture honey bee crop pollination has an annual worth of \$15 billion dollar. However, bee colonies experience high mortality rates, with 50% yearly losses in the Upper Midwest, including in Iowa. It is imperative to study and try to mitigate this phenomenon. Previous studies at Iowa State University have shown a concerning bee health decline at the end of summer, regarding low individual bee fat stores and low colony honey stores. In this project we assess stress responses in honey bees. As compared to bees in a soybean dominated landscape where colonies may suffer from pesticides and poor nutrition, we expect that honey bees kept at Iowa prairie landscapes experience less stress. We compare bees from prairie and soybean landscapes by means of real time quantitative RT-PCR. Gene expression of detoxification enzymes and heat shock proteins is measured. Our data can indicate to what extent access to prairie plants may help mitigate stress in honey bee colonies. Future studies can assess if the planting of prairie strips between crops helps to support bee honey health in an agriculture dominated landscape.

## II.E.2 **Mirror-Induced Behavior in Paper-Wasps: Is an Insect Capable of Self-Recognition?**

**Presenter:** *Jessica Riojas*, Environmental Science and Biology

**Mentor:** Amy Toth, Ecology, Evolution, and Organismal Biology

**Abstract:** Mirror-induced behavior has been used to provide a window into understanding animal cognition and consciousness. Recent studies suggest that some animal species, especially those that possess high levels of intelligence and complex social lives, are able to recognize themselves in a mirror. Using a "mark-test," an individual is marked in a spot which it cannot see without a mirror, and if the individual explores the mark (grooming, examining, or self-touching), then the species has been described as capable of mirror self-recognition (MSR). We were interested to test whether *Polistes* paper wasps are capable of MSR, because these insects are highly intelligent social animals that use individual recognition of other wasps as part of their natural nesting behavior. MSR was tested in the laboratory by recording and scoring behavior on individual wasps being exposed to mirrors with and without visible marks, as well as several controls including non-reflective stimuli and other wasps. In addition, we are also investigating the molecular mechanisms of cognitive behaviors in the wasps tested behaviorally for MSR by studying gene expression in the brains of individual wasps. If *Polistes* are found capable of MSR, this would be the first demonstration of self-recognition in an invertebrate. This study could expand the idea of the types of cognitive tasks vertebrate minds are capable of and contribute to a growing body of evidence that miniature nervous systems of insects do not limit sophisticated behaviors.

Session II.F  
11:00 – 12:00  
Oak Room

## KINESIOLOGY AND HEALTH

**Faculty Moderator:** Elizabeth Stegemoller, Kinesiology

### II.F.1 **Cardiovascular Function and Stress in Parkinson's Disease**

**Presenters:** *Rebekah Trost*, Kinesiology and Health, *Cailie Logue*, Kinesiology and Health

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** Cardiovascular dysfunction and dysautonomias including orthostatic hypotension are common in individuals with Parkinson's disease (PD) (Zeimssen and Reichmann, 2007). Thus, persons with PD may have an impaired cardiovascular response to stress. The purpose of this study was to determine if patients with PD have an altered cardiovascular stress response. Participants with PD with no other neuromuscular diseases, aged 55-80, were age and gender-matched with healthy older adults (HOAs). Two conditions (cold-presser and control) were counterbalanced with a 1 hour break in between. In the cold-presser condition, participants submerged their hand in a 2-4 °C ice bath for 90 sec. For the control condition, a warm 67.7 °C warm water bath was used. Following each condition, perceived stress (PS), heart rate (HR), and blood pressure (BP) were measured. A mixed measures ANOVA was used to determine group, condition, and interaction effects. Significance was set at  $\alpha = .05$ . Compared to the control condition the cold-presser condition resulted in significantly higher levels of systolic BP ( $p = .03$ ), diastolic BP ( $p = .05$ ), and perceived stress ( $p < .001$ ) in both groups. There was no significant change in heart rate for either group. There was no main effect of group or interaction effects for any of the outcome measures. These results suggest that persons with PD and HOA's

have a similar cardiovascular and perceptual stress response when exposed to a physical stressor such as the cold presser test.

II.F.2 **Changes in Cognitive Processing, Working Memory, and Anhedonia in Response to Exercise in Individuals with Major Depressive Disorder**

**Presenter:** Jenna King, Kinesiology and Health

**Mentor:** Jacob Meyer, Kinesiology

**Abstract:** Factors associated with depression, including cognitive processing, working memory and anhedonia (diminished ability to feel interest/pleasure), are influenced by acute exercise, yet the time-course of these changes following exercise is unknown, particularly in patients suffering from depression. This time-course could be used to determine when individuals are most receptive to treatment and therapy sessions, resulting in the subsequent design of intentionally combined exercise-therapy treatment, that could enhance treatment outcomes. The purpose of this study is to examine the changes in these factors in response to an acute exercise session compared to a quiet rest session in individuals with major depressive disorder (MDD). Thirteen participants with MDD currently experiencing a major depressive episode completed both a moderate cycling exercise and a quiet rest session while answering questionnaires and completing cognitive tasks at six time points before, during, and up to 75 minutes after the session. Cognitive processing and working memory, measured through reaction time and accuracy of the N-back and Stroop tasks, respectively, and anhedonia, measured through the Dimensional Anhedonia Rating Scale, were gathered at all six time points. Mean values were calculated for each time point and compared between exercise and quiet rest sessions. Descriptive results suggest that cognitive processing and working memory were not largely influenced by exercise compared to quiet rest, but anhedonia was improved in response to exercise. The anhedonia results suggest that the time immediately following exercise up through 50 minutes post-exercise may be the window where psychological factors associated with depression are most impacted by acute aerobic exercise. This could allow for more effective treatment by providing exercise immediately preceding therapy, allowing individuals with MDD to potentially need fewer in-person sessions and resulting in better treatment outcomes.

II.F.3 **Associations of Cardiorespiratory Fitness and Muscular Strength with Mental Cognition in Older Adults**

**Presenter:** Tilak Patel, Kinesiology

**Mentor:** Angelique Brellenthin, Kinesiology

**Abstract:** The motivation for the research stems from the pursuit of wanting to make health better on a full spectrum. Human medicine has come a long way in reactive medicine but seems to lag in the proactive pursuit. The point of this research is to develop a better understanding of how different models of exercise in the geriatric population might be more effective in slowing down the degradation of mental cognition. Data was collected from the Physical Activity and Aging Study (PAAS), which is an ongoing prospective cohort study in over 700 older adults. This cross-sectional study will include approximately 329 participants with a mean age of 72 ( $\pm 6$ ) years, who have complete fitness and cognition data. Muscular strength (MS) assessed by a maximal hand grip contraction (kg) and cardio respiratory fitness (CRF) is assessed with a 400-meter walk test (minutes to complete), both of which are valid measurements of MS and CRF in an older adult population. Domain specific cognitive functions are assessed with the Stroop color-word task (processing speed) and the digit span test (memory). Multivariable linear regression will be used to determine the associations of MS and CRF with cognitive outcomes in men and women. MS and CRF will also be dichotomized into either weak or unfit, or strong or fit in a joint analysis of CRF and MS with cognition. Statistical models will include covariates such as age, education level, and other lifestyle variables (smoking, alcohol consumption). This research's implications are that it might change how exercise in the geriatric population should be pursued. And future research could modulate the more effective modal (MS or CRF) to make it even more effective or efficient.

II.F.4 **Effect of Music and Exercise on Motor Function in People with Parkinson's Disease**

**Presenters:** Mikayla Weron, Kinesiology and Health, Claire Bridges, Kinesiology and Health

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** Previous research has shown acute improvements in motor symptoms and mobility in people with Parkinson's disease (PD) following music and exercise interventions. However, it remains unknown how long these improvements last. The purpose of this research is to determine the duration of improved motor symptoms and mobility following one session each of dancing, singing, boxing, and yoga. The Unified

Parkinson's Disease Rating Scale (UPDRS) and a Timed Up and Go (TUG) test will be obtained prior to session participation, immediately after session completion, thirty minutes post session completion, and one hour post session completion. Changes in UPDRS and TUG scores will be analyzed using 2x4 repeated measure ANOVA. We expect that the dance session, which consists of both exercise and music, will demonstrate the longest improvement in motor symptoms and mobility. Results of this study may inform participants how to schedule activities of daily living according to benefits received after music and exercise interventions.

Session II.G  
11:00 – 12:00  
Room 3534

## ENVIRONMENTAL SCIENCE

**Faculty Moderator: Rachel Eike Apparel, Events and Hospitality Management**

### II.G.1 **Capturing Iowa Lakeside Lab's Dark Data**

**Presenter:** *Sydney Weldon*, Biology

**Mentor:** Lori Biederman, Ecology, Evolution and Organismal Biology

**Abstract:** The Iowa Lakeside Laboratory, founded in 1909 for "the study of nature in nature," is owned by the state of Iowa and operated through the Board of Regents. Thousands of early 20th century natural history specimens have recently been rediscovered in cabinets across the campus, including 910 mosses, 5,786 vascular plants, 365 birds, thousands of insects, and hundreds of fungal specimens. An ISU scientist has launched a crowdsourcing effort engaging hundreds of citizen scientists in cataloguing the nearly 8,500 specimens photographed during the summer of 2018. The value of natural history collections is relatively untapped, with archived specimens revealing the wonder of the biological world as it has existed through time. This repository has incredible potential to aid global change research, providing the data needed to track fluctuations in geographic distributions, phenology, and the spread of diseases. Bringing this massive dataset to light advances our understanding of taxonomy, climate change, conservation, and resource management.

### II.G.2 **Balancing Conservation And Economics To Improve Water Quality In Iowa And Beyond**

**Presenter:** *Lucas Goodman*, Animal Ecology and Environmental Studies

**Mentor:** Thomas Isenhardt, Natural Resource Ecology and Management

**Abstract:** Nitrogen and phosphorus runoff or nutrient pollution from agricultural landscapes affects water quality throughout the country, removing oxygen from the Gulf of Mexico and creating one of the largest dead zones in the world. The influx of these nutrients into waterways negatively impacts human health, biodiversity, the US economy, and efforts to purify drinking water. To address this issue at the state-level, Iowa introduced the Iowa Nutrient Reduction Strategy to reduce both nitrogen and phosphorus runoff to surface waters by 45%. One way to reduce nutrient pollution is through the use of best management practices (BMPs) to retain nutrients and enhance water quality. The federal government invests billions of dollars in the Midwestern United States towards BMP effectiveness; yet, local and regional water quality continues to decline. Our study uses geospatial data to identify optimal placement of BMPs in a Central Iowa watershed by strategically locating BMPs to align with nutrient concerns and cost-effectiveness. We compare our model to existing BMPs to improve conservation planning within agricultural landscapes, maximize nutrient removal, and minimize land taken out of production. The success of our efforts could advance conservation strategies in a cost-effective manner and help preserve our health, habitats, and ecosystems.

Session II.H  
11:00 – 12:00  
Gold Room

## PSYCHOLOGY AND MASS COMMUNICATION

**Faculty Moderator: Christina Svec, Music and Theatre**

### II.H.1 **Assessing Empathy in Persuasive Health, Environment and Risk Communication**

**Presenters:** *Emily Haberlack*, Environmental Science, Environmental Studies, and Sociology

**Mentor:** Dara Wald, Greenlee School of Journalism and Communication

**Abstract:** Understanding that empathy matters is not the same as understanding how it develops and operates within the communication process. Previous scholars have described empathy as an important part of message design, message processing, emotional-arousal and altruistic/prosocial responses to persuasive messaging. Yet the current literature is lacking many systematic reviews of empathic communication in the domains of

science, environment and risk. Using a systematic approach to review 127 peer-reviewed articles, we identify key themes in the use of empathy and empathy-arousing messages in communication. Methods: Key terms (empath\* OR altruis\* OR {perspective taking} OR {affect\* arousal} OR {emotion\* response} OR {emotion\* arousal} OR emotion\*) were entered to identify articles for potential inclusion. Two coders evaluated each article, and key details about research methods, variable measurement and outcome measures were recorded. The connections between empathy and trust, perceived risk and empathic behaviors in the articles were also recorded. Initial findings indicate that empathic abilities can be changed or manipulated, and empathy can be aroused in short-term interventions. However, it is important to note that individuals have different empathic abilities (high vs. low), and these baseline levels of empathy can impact empathy arousal and prosocial responses. It is also shown that studies on empathy and communication were widespread in the field of health communication, but minimal in the area of environmental and risk communication. Conclusion: We present a review of previous empathic communication methodologies and offer proposals for future research.

## II.H.2 **Exploring Relations Between Dark Personality Traits, Media Violence Exposure, and Finding Humor in Media Violence**

**Presenter:** *Sabrina Ash*, Psychology

**Mentor:** Craig Anderson, Psychology

**Abstract:** Who finds media violence funny? Several “dark” personality traits may predict this. We consider there to be six dark personality traits: narcissism (only has an interest in themselves), psychopathy (cruel disregard for others), Machiavellianism (can easily manipulate others), schadenfreude (finding pleasure in another person’s pain), spitefulness (willing to incur a cost to cause harm towards another person), and everyday sadism (harming others for pleasure). People with these traits have little or no empathy towards others and, at some level, find pleasure in another person’s pain. These features are what we believe leads people to find humor in media violence. People who are desensitized normally show little or no empathy towards others. It seems that desensitization at an extreme form would be shown as finding humor in media violence. We believe that people with these dark personality traits are desensitized and will find humor in media violence. We tested these hypotheses in a cross-sectional study and found that some of the dark personality traits were associated with finding humor in media violence.

# SESSION III, 1:00 pm – 2:15 pm

Session III.A  
1:00 – 2:15  
Cardinal Room

## MATERIALS ENGINEERING

**Faculty Moderator:** Svitlana Zbarska, Undergraduate Research program coordinator

### III.A.1 **Development of Copper Based Elastocaloric Materials**

**Presenter:** *Emery Farmer*, Material Science and Engineering

**Mentor:** Jun Cui, Material Science and Engineering

**Abstract:** Elastocaloric cooling uses the latent heat associated with the stress-induced solid-state phase transformation to pump heat. It is a novel cooling technology that has demonstrated high efficiency and minimum environmental impact. In 2014, U.S. Department of Energy ranked it as the most promising new HVAC technology to replace vapor compression. While many alloys exhibit elastocaloric effect, few can simultaneously meet the criteria on large temperature lift, small biasing stress, and low cost. To date, NiTi remains as the best material for elastocaloric cooling application. However, NiTi requires large stress (>600 MPa) and it is prohibitively expensive, which makes it difficult for widespread industrial and consumer applications.

The Cu-Al-Ni ternary system has been investigated in the past for its shape memory properties. The alloying elements in the system affect the temperature at which the martensitic transformation takes place as well as the latent heat of the transformation. We are investigating the transition temperatures and latent heats of the system using a combinatorial materials synthesis technique in order to evaluate hundreds of compositions in a few weeks of time. The objective of the current study is to map compositions, latent heat, and transition temperature relations. To analyze the samples, differential thermal analysis and x-ray fluorescence have been used. The highlight of the experimental method is the utilization of a thermo-camera to replace the traditional

Differential Scanning Calorimeter, saving the project months of time. To date, the study has produced twelve compositions that have desirable latent heats in the temperature range. The largest latent heat shown thus far is 8 joules per gram. The project will be complete when all of the compositions have been analyzed.

### III.A.2 **Optimization of Mixed Glass Former/Mixed Anion Glassy Electrolytes through the Utilization of Planetary Ball Milling**

**Presenter:** *Onel Valdez*, Materials Science Engineering

**Mentor:** Steven Kmiec, Materials Science Engineering

**Abstract:** A series of mixed glass former (MGF) and mixed Activation Energy and Conductivity in Relation to RPM anion glassy electrolytes were prepared via planetary ball milling (PBM) techniques under different milling conditions. To better understand the effect milling speed has on the electrical properties, the  $\text{Li}_2\text{S} + \text{SiS}_2 + \text{P}_2\text{O}_5$  composition was milled for 10 hours each at various speeds with the ionic conductivity and activation energy measured afterwards. It was found that higher milling speeds impart enough energy to completely react the starting materials and as a result produce higher magnitude orders of ionic conductivities.

### III.A.3 **A Study of Kinetic Fragility Along the Na4P2S7-xOx Glass Series**

**Presenter:** *Jacob Lovi*, Materials Engineering

**Mentor:** Steve Martin, Materials Science and Engineering

**Abstract:** Kinetic fragility ( $m$ ) characterizes the change in the dynamics of a liquid as it is cooled towards its glass transition ( $T_g$ ). It is a very telling variable that has applications such as determining the temperature dependent viscosity of a glass using the MYEGA model as well as comparing the relative behavior of glasses along a series. Traditionally a calorimetric method has been used to determine this  $m$  value, but recently a new DSC method derived from the MYEGA model has been explored and shows promise in finding more accurate  $m$  values. Currently this method can take many days to obtain reliable  $m$  values for a single sample, however, trends of the TRRD method suggest that  $T_g$  and structure can be directly related to  $m$ . If this is true, reliable  $m$  values could be found much faster as only a few DSC scans and knowledge of the glass's structure would be needed to calculate  $m$ . This poster demonstrates the new method's ability to predict  $m$  values across the Na4P2S7-xOx series, along with supporting evidence showing the accuracy of this TRRD method as well as evidence that  $T_g$  and structure directly affect  $m$ .

### III.A.4 **Fueling Space Exploration: Engineering Materials to Produce Rocket Fuel on Mars**

**Presenter:** *Brandon Vance*, Chemical Engineering

**Mentor:** Jean-Philippe Tessonnier, Chemical and Biological Engineering

**Abstract:** One of NASA's future goals in space exploration is to send crewed missions to Mars. However, sending the fuel needed to return the crew to Earth is logistically and financially impossible. NASA's solution is to produce the return rocket fuel directly on Mars by using a supported-metal catalyst to facilitate the generation of methane gas from Mars' natural resources: carbon dioxide and water. This conversion requires harsh reaction conditions that induce irreversible deactivation of the catalyst, which has proven to be a major obstacle in engineering a catalyst for Mars applications. To design a robust catalyst, we must fully understand every factor that affects the catalytic activity, including the ability of the metal catalyst to increase the rate of methane generation. This study examines the influence of the support's thermal conductivity on methane production to determine the catalytic activity's dependence on heat transfer within the catalyst particle. Our results demonstrate that the activity of supported-metal catalysts are directly affected by the support's ability to remove the heat of reaction from the metal nanoparticles. Coupling these findings with future investigations will enable a catalyst to be engineered for the production of rocket fuel on Mars.

Session III.B  
1:00 – 2:15  
Oak Room

## MECHANICAL ENGINEERING

**Faculty Moderator:** James Michael, Mechanical Engineering

### III.B.1 **Creating Repeatable Shock Wave Pressures Using a Customized Scoring Device for Diaphragms**

**Presenter:** *Megan Beck*, Mechanical Engineering

**Mentor:** Sarah Bentil, Mechanical Engineering

**Abstract:** Blast-induced traumatic brain injury (bTBI) is the leading cause of injury to members of the United States Armed Forces. This injury occurs when a shock wave impacts and propagates through the head, following detonation of a bomb or improvised explosive device (IED). Symptoms of bTBI (e.g. memory loss and/or post-traumatic stress disorder (PTSD)) cannot be prevented by wearing combat helmets, which are designed to protect against skull fracture and penetrating objects. Designing a helmet that can also prevent bTBI requires shock tube experiments to assess the helmet's response to a shock wave. A shock wave is created by a shock tube when a thin diaphragm ruptures due to pressurization of a compressible gas or ignition of an air-fuel mix. Creating repeatable shock waves are contingent on the diaphragm. The objective of this project was to design and fabricate a device that scores a diaphragm, made from dead soft aluminum, to produce repeatable rupture pressure. A standard procedure was created for preparing the diaphragm in shock tube experiments. The shock tube experiments showed that scoring the diaphragm surface prevented fragments of dead soft aluminum to travel down the length of the shock tube. The experiments also concluded that the device and procedure used to prepare the diaphragms yielded repeatable rupture pressures, regardless of the diaphragm thickness. The data also showed a linear relationship between the number of diaphragm sheets inserted into the shock tube, to increase the diaphragm's thickness, and rupture pressure.

### III.B.2 **Parametric Modeling and Design of Tricuspid Heart Valves**

**Presenter:** *Caroline Crisp*, Mechanical Engineering

**Mentor:** Ming-Chen Hsu, Mechanical Engineering

**Abstract:** Currently, there are about 1.6 million Americans diagnosed with tricuspid valve regurgitation, which occurs when the tricuspid valve does not properly close to prevent backward blood flow into the right atrium; however, only about 8,000 individuals within that group will undergo valvular surgery. The proposed methods will help study tricuspid valve behavior so that its biomechanical response can be examined and more effective surgical procedures can evolve. This work focuses on developing a parametric tricuspid valve that can be adapted to match the shape of a patient-specific native valve. We utilize CAD modeling software that allows the main features of the tricuspid valve geometry to be considered. The valve and chordae tendineae are parametrically modeled with non-uniform rational basis spline (NURBS) surfaces and curves. This process incorporates patient-specific data and a versatile interpretation of the tricuspid valve to generate a simplified model that still accurately captures the valve structure. This type of simplified parametric design may also provide a baseline to optimize prosthetic valve designs with less intricate structures than native tricuspid valves.

Session III.C

1:00 – 2:15

Cardinal Room

## PSYCHOLOGY

**Faculty Moderator:** Susan Yager, English

### III.C.1 **Do Jurors Need Less Evidence To Convict Minority Defendants?**

**Presenter:** *Natalie Teclaw*, Psychology, Criminal Justice, and Sociology

**Mentor:** Kristen Slapinski, Psychology

**Abstract:** Seventy percent of proven wrongful convictions involve minority defendants (see [www.innocenceproject.org](http://www.innocenceproject.org)). The aim of the present research is to examine whether this phenomenon can be partially attributed to a threshold effect whereby jurors require less evidence to reach a guilty verdict when the defendant is a minority and/or matches a specific criminal stereotype. This hypothesis is supported by social psychological theory related to stereotypes. Specifically, jurors view minority defendants as more stereotypically likely to commit crime in general, and as more stereotypically likely to commit certain types of crimes (e.g., African-Americans and gang-violence). Because of this, jurors view those defendants as more likely to be guilty, resulting in a lower threshold for evidence necessary to reach a guilty verdict. Study 1 will utilize a three-cell (defendant ethnicity: Latino, African-American, non-Latino white) between-subjects design to examine whether defendant ethnicity independently influences the amount of evidence needed to reach a guilty verdict. Study 2 will utilize a 2 (defendant ethnicity: Latino vs. non-Latino white) x 2 (crime type: stereotypic vs. non-stereotypic) between-subjects design to examine whether this effect is amplified when the defendant matches a specific crime stereotype. Undergraduate participants (both studies) and a sample of jury-eligible adults recruited via Turk Prime (Study 2) will read a fictitious case summary and then view individual pieces of case evidence, one at a time, until they are ready to reach a verdict. The amount of

evidence presented before reaching a verdict will constitute the primary dependent variable. Results will illustrate whether jurors need less evidence to convict a minority defendant and whether this effect is amplified when a defendant matches a specific criminal stereotype. Data collection is currently in progress.

### III.C.2 **Exploring Relations Between Dark Personality Traits, Media Violence Exposure, and Finding Humor in Media Violence**

**Presenter:** *Sabrina Ash*, Psychology

**Mentor:** Craig Anderson, Psychology

**Abstract:** Who finds media violence funny? Several “dark” personality traits may predict this. We consider there to be six dark personality traits: narcissism (only has an interest in themselves), psychopathy (cruel disregard for others), Machiavellianism (can easily manipulate others), schadenfreude (finding pleasure in another person’s pain), spitefulness (willing to incur a cost to cause harm towards another person), and everyday sadism (harming others for pleasure). People with these traits have little or no empathy towards others and, at some level, find pleasure in another person’s pain. These features are what we believe leads people to find humor in media violence. People who are desensitized normally show little or no empathy towards others. It seems that desensitization at an extreme form would be shown as finding humor in media violence. We believe that people with these dark personality traits are desensitized and will find humor in media violence. We tested these hypotheses in a cross-sectional study and found that some of the dark personality traits were associated with finding humor in media violence.

### III.C.3 **Abriendo Caminos: Promoting Healthy Family Mealtime Routines and Climate Among Mexican Immigrant Families**

**Presenter:** *Alondra Sanchez-Laguna*, Bachelor of Liberal Studies

**Mentor:** Kimberly Greder, Human Development and Family Studies

**Abstract:** Abriendo Caminos (AC) is designed to promote family health among low income, Mexican immigrant families. The primary research questions proposed for this study include, “Do family mealtime routines and mealtime climate improve among families after participation in Abriendo Caminos?” and “Does improvement of family mealtime routines and climate differ by parent gender?” This study is based on data collected at three time points each over an eight month period from Mexican immigrant fathers (T0=33; T1=27; T2=28) and mothers (T0=64; T1=54; T2=60) who participated in cohort 1 and 2 of the Abriendo Caminos program in Iowa with their children during 2017-2019. Differences in Family Mealtime Routines (FMR) and Family Mealtime Climate (FMC) results were reported by both the intervention and the control groups and by gender from self-report responses to the 12-item FMR and the 8-item FMC questionnaires. The FMR questionnaire used a 3-point Likert scale and the FMC used a 5-point Likert scale. Responses to questions were reverse recoded as appropriate. Another variable was added when graphing data collected from participants and a family score was created. Most of the scores between control and intervention groups among the three time points data was collected, results fluctuated slightly, but seemed to usually end with a slightly higher score than when it was first collected. Positive impact on family mealtime routines and family mealtime climate showed differences before and after families participated in Abriendo Caminos. We will continue to change and refine this program to see more positive results in the improvement of these Latinx immigrant families. To help maintain motivation in often maintaining the education for a healthier lifestyle and positive family mealtimes. As well as improve measures to get more consistent scores.

Session III.D  
1:00 – 2:15  
Room 3505

## ELECTRICAL ENGINEERING

**Faculty Moderator:** Ratnesh Kumar, Electrical and Computer Engineering

### III.D.1 **Comparison between FlexiForce Sensors and a Low-cost Capacitive Force Sensor Exposed to a Shock Wave**

**Presenter:** *Marcelo Christhiam Gomes Abrantes*, Electrical Engineering

**Mentor:** Sarah Bentil, Mechanical Engineering

**Abstract:** In recent years, there has been an escalation of blast-induced traumatic brain injuries (bTBI) caused by improvised explosive devices (IEDs). Thus, designing helmets that can mitigate bTBI would be invaluable. Force-sensitive resistors (FSR) can be instrumented onto a helmet, to quantify the force applied from a shock wave created by an IED. The force is correlated with the FSR sensor and provides insight into bTBI mechanisms.

However, not all FSR sensors provide the same precision measurements. The aim of this project is to compare measurements from a commercially available FSR sensor (FlexiForce by Tekscan) and a low-cost do-it-yourself (DIY) capacitive force sensor (MACap), due to shock wave exposure. Two different Tekscan sensors were considered: FlexiForce A201 and FlexiForce B201. FlexiForce A201 has a three-pin connection, which facilitates connection to a protoboard. An oscilloscope is then connected to the output of an active inverting operational amplifier (op-amp) low pass filter. The FlexiForce B201 connects to Tekscan's data acquisition hardware and software, called the ELF™ system. The MACap varies its capacitance according to the force applied and consists of two layers of aluminum foil (electrodes), which are separated by a layer of neoprene foam (dielectric material). An RC circuit, connected to an unit-gain buffer, was used to filter the signal. An Arduino UNO was responsible for storing MACap readings. The results showed that both FlexiForce sensors were not reliable for shock wave pressures below 3 kPa, which was not a problem for the MACap sensor. The MACap sensor was more susceptible to external interference than the FlexiForce sensors. A comparison between FlexiForce A201 and B201 showed that the A201 yielded reproducible and reliable data with less noise, due to the use of an op-amp filter.

### III.D.2 Identifying Cancerous Images Using Neural Networks

**Presenters:** *Mohamed Gesalla*, Electrical Engineering

**Mentor:** Julia Dickerson, Electrical and Computer Engineering

**Abstract:** Diagnosing terminal diseases like heart disease, Alzheimer's, or cancer remains a complex process. Despite scientific and technological advancements in the research of incurable diseases, human error exists. Machine learning algorithms, capable of receiving, decoding, stimulating, and analyzing complex sets of data and best known for their use in creating self-driving cars, are becoming more prominent in disciplines like healthcare, increasing opportunities for early diagnoses of fatal and terminal diseases. This research focuses on developing a machine learning model to help classify lung cancerous images while eliminating diagnostic errors. Using Artificial Neural Networks and a collection of Python programming functions and methods, 400 x-rays computed tomography lung cancerous images were obtained from the Cancer Genome Atlas (TCGA) data collection and used as training data for this model. The data set includes patients from diverse demographics, clinical events, and genomic data. Backpropagation algorithms were used to train the neural networks to interpret the specific set of data starting with a simple benchmark problem for recognizing hand written numbers. The accuracy of this model was tested using 75 x-rays computed tomography images containing a mixture of cancerous and non-cancerous images. Our model achieved 75% accuracy in identifying and distinguishing cancerous images. While the current model has yet to prove its value and long-term contribution to the healthcare industry, further research is committed to the development of higher accuracy models using Convolutional Artificial Neural Networks (CANN) that provide higher accuracy in image recognition models while requiring minimal preprocessing.

Session III.E  
1:00 – 2:15  
Room 3558

## CIVIL ENGINEERING

**Faculty Moderator:** **Claus Kadelka, Mathematics**

### III.E.1 TIMELI: Using Data Analysis to Improve Traffic Safety

**Presenter:** *Philip Cordova*, Computer Science

**Mentor:** Anuj Sharma, Civil, Construction, and Environmental Engineering

**Abstract:** The Federal Highway Administration (FHWA) estimates that a quarter of the congestion on U.S. roads is due to traffic incidents such as a crash, an overturned truck, stalled vehicles, or a variety of other impediments to normal traffic flow. Iowa State University (ISU) and its partners TransCore and Iowa DOT propose TIMELI (Traffic Incident Management Enabled by Large-data Innovations): a new, robust traffic incident management system integrating innovative data analysis techniques to monitor traffic incidents in real time, proactively control risk, quickly detect traffic incidents, identify the location and potential cause of these incidents, and suggest traffic control alternatives. Our goal in this project is to implement camera-based traffic incident detection and congestion detection algorithms on a statewide level and develop a user-interface to efficiently show the detected incidents to traffic incident managers (TIMs). The incident and congestion detection algorithms are being implemented in server-based multiple Graphical Processing Units (GPUs) to handle more than 300 cameras installed across the state of Iowa. These algorithms are based on state-of-the-

art deep learning techniques to build a robust incident detection system. Our user-interface is also designed to minimize the time spent by TIMs in managing the detected incidents, thereby reducing their cognitive load.

### III.E.2 **Pavement Thermodynamics at Great Mosque of Makkah, Saudi Arabia**

**Presenter:** *Shatha Alghamdy*, Civil Engineering

**Mentor:** James Alleman, Civil, Construction and Environmental Engineering

**Abstract:** The Grand Mosque in Makkah is the first mosque in the world. Between 2010 and 2015 the Great Mosque of Makkah underwent a major construction effort to secure the following three major outcomes: 1) a significant increase with this site's physical footprint, 2) a similarly substantial increase in available space for pedestrian access to this extremely holy site, and 3) widespread (nearly 1.2 million square meters) use of a pure white, and highly reflective, marble paving material. Assumedly, the latter placement of the marble surface was intended to provide aesthetic benefits appropriate for this site's religious heritage and solemnity. At the same time, though, it is highly likely that this project's involved architects and engineers would have known, and expected, this marble to provide an additional range of thermodynamic benefits (ala' lower uptake of daytime solar radiation energy, cooler daytime pavement temperatures, and possibly even cooler overlying air temperatures, where all of these benefits would have helped reduce heat stress for site visitors. In turn, this poster's presentation will provide a preliminary engineering assessment of the thermodynamic impacts with this latter new pavement surface, based on a comparison of projected pavement temperatures during short two-week periods during January and June 2018. Future work will evaluate more detailed changes with both surface air temperature and pavement heat transfer based on a full three-year weather database obtained at this site (i.e., extending from 2015 to 2018) covering the Great Mosque and five surrounding stations within 6 to 12 kilometers.

### III.E.3 **Optimizing Maintenance Equipment Life Cycle for Local Agencies**

**Presenter:** *Caria Collins*, Civil Engineering

**Mentor:** Jennifer Shane, Civil Engineering

**Abstract:** Many local agencies throughout the state of Iowa have substantial amounts of equipment fleet that require management, utilization, and replacement. Due to lack of programming, and economic trade-offs the equipment is difficult to overall optimize. To alleviate this problem, a spreadsheet based decision support tool will developed to guide agencies to minimize cost and maximize optimization. Through data collection, a questionnaire survey, evaluation of current practices for equipment life cycle cost management framework and algorithms, agencies will be able to input parameters and "what-if" constraints and the tool will generate a comprehensive output that relays an informed and optimized decision on selecting the best option for fleet management options under consideration. Various equipment will be evaluated and their vital factors will be considered. Different factors will be taken into account for a multi-criteria decision making model. Based off of constraints and parameters, an algorithm will aid in generating outputs that not will be of use for budgets, but capital purchasing decisions as well. End users will be able to compare actual equipment costs to those found in the program's output.

Session III.F  
1:00 – 2:15  
Room 3512

## KINESIOLOGY AND HEALTH

**Faculty Moderator:** Rudy Valentine, Kinesiology

### III.F.1 **Peer Health Coaching for Physical Activity, Self-Efficacy, and Stress in College Students**

**Presenter:** *Kylee Joiner*, Kinesiology and Health and Global Resource Systems

**Mentor:** Gregory Welk, Kinesiology

**Abstract:**

**Purpose:** Motivational Interviewing (MI) is a directive, client-based technique used within health coaching (HC) to elicit motivation for behavior change. The purpose of this study is to evaluate the impact of a MI-based HC program on student physical activity (PA) levels and stress levels.

**Methods:** Data were collected through on ongoing peer health coaching initiative designed to promote student wellness. Incoming undergraduate students are paired with a trained health coach student and guided using MI techniques to improve a self-directed goal. A subsample of 38 students (age  $18.9 \pm 0.9$ ; 79% female) that identified PA as the target goal were used in the present analyses. Participants completed surveys before and

after 8 weeks of HC (4 sessions total), to assess behavior changes. The International Physical Activity Questionnaire (Short-Form) was used to assess PA; the Exercise and Confidence Survey was used to capture two indicators of self-efficacy (SE) for PA; and the Perceived Stress Scale was used to assess stress levels. Statistical analyses included paired samples t-tests to examine pre and post differences, and Cohen's d effect sizes.

Results: Total PA significantly increased from baseline to follow up ( $99.4 \pm 47.6$  minutes/week vs.  $135.8 \pm 83.9$  minutes/week) ( $p < 0.01$ ), resulting in a moderate effect size ( $d=0.53$ ). The two indicators of SE also both had large and significant gains from baseline to follow up demonstrating gains in perceived confidence for making time for PA ( $d=0.71$ ) and sticking to PA ( $d=0.71$ ). Stress levels also significantly decreased ( $19.5 \pm 6.2$  vs.  $15.1 \pm 6.0$ ;  $p < 0.01$ ) resulting in a large effect ( $d=0.72$ ).

Conclusion: HC seems to be an effective source of accountability to increase PA and SE and reduce stress for incoming college students. Future research should focus on the degree to which HC maintains improved lifestyle behavior habits long-term.

### III.F.2 **The Effects of Boxing Therapy on Upper Extremity Muscle Activity in Persons with Parkinson's Disease**

**Presenters:** *Thomas Berta*, Kinesiology, *Matthew Turk*, Kinesiology

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** Non-contact boxing is a current, trending alternative form of therapeutic physical activity for people with PD to target and improve their mobility, balance, and overall quality of life. However, there is little evidence available to support the efficacy of a boxing program on motor symptoms with PD. The purpose of this study is to examine upper extremity muscle activity before and after one session of non-contact boxing in people with PD, healthy younger and healthy older adults. Data was collected using wireless electromyography (EMG) sensors attached to the biceps brachii and triceps brachii of each participant. The participants were asked to flex and extend at the elbow joint under two different conditions: self-paced and fast-paced. Preliminary results demonstrated a decrease in peak EMG, time to onset, and time to offset. This may suggest that non-contact boxing increases muscle efficiency in people with PD. Future studies require a larger sample and inclusion of more functional movements to better analyze the effectiveness of a modified boxing program as an alternative therapeutic tool for people with PD.

Session III.G  
1:00 – 2:15  
Gold Room

## MICROBIOLOGY

**Faculty Moderator:** Mark Rasmussen, Microbiology

### III.G.1 **Effect Of Repeated Low-Level Hydrogen Sulfide Exposure On Pathogenicity Of Influenza- A Virus In Pigs**

**Presenter:** *Amber Vegter*, Biology and Animal Science

**Mentor:** Wilson Rumbelha, Veterinary Diagnostic and Production Animal Medicine

**Abstract:** Hydrogen sulfide (H<sub>2</sub>S) is a naturally occurring respiratory irritant found within commercial swine confinements. Limited studies in rats have indicated that H<sub>2</sub>S exposure increases retention of bacteria in the respiratory tract (RT). No such studies have been conducted in pigs. Influenza A virus (IAV) is an important zoonotic disease of the RT. We hypothesized that low-level exposure to H<sub>2</sub>S increases pig susceptibility to IAV. Following 3 days of acclimation, thirty- five (35) 3-week-old pigs were randomly split into the following groups: Group 1 exposed to breathing air (BA) only/not challenged (NC); Group 2 exposed to BA/challenged with IAV (C); Group 3 exposed to 0.5 ppm H<sub>2</sub>S/C; Group 4 exposed to 5 ppm H<sub>2</sub>S/C; Group 5 exposed to 50 ppm H<sub>2</sub>S/NC; and Group 6 exposed to 50 ppm H<sub>2</sub>S/C. Pigs were exposed daily for 6 hours for 12 days. On the seventh day (dpi 0), pigs were inoculated with a 2014 strain of H3N2 IAV. Nasal swabs, blood, and body weights were taken before inoculation and periodically thereafter. Clinical observations and rectal temperatures were taken daily. Pigs were necropsied on 5 dpi, lung lesions grossly evaluated, and lung, distal trachea, and nasal turbinate samples taken for histological evaluation. Serum and bronchoalveolar lavage fluids (BAL) were taken also for cytokine analysis. Preliminary results indicate a significant increase in body temperature in groups 3 and 6 pigs compared to control. Pigs exposed to H<sub>2</sub>S and to IAV clinically manifested more labored breathing than those given BA/C. H<sub>2</sub>S at 50 ppm with or without challenge had a suppressed body weight gain. Mean macroscopic lung lesions were higher in the 0.5 ppm/C and 50 ppm/C groups compared to the BA/C group. Overall IAV challenge appeared to worsen the outcome of H<sub>2</sub>S inhalation exposure.

III.G.2 **Synthesis of a mRNA vs protein vaccine: a possible treatment to prevent human parainfluenza virus in children**

**Presenter:** *Natalie Lohmann*, Biology

**Mentor:** David Verhoeven, Veterinary Microbiology and Preventive Medicine

**Abstract:** Human parainfluenza virus (HPIV) is the second most common viral respiratory pathogen in young children. The virus causes symptoms such as fever, cough, and runny nose, and it has the potential to lead to more serious infection in the respiratory tract and often fosters secondary bacterial infections in the middle ears. Currently, there is no vaccine for HPIV or antiviral treatment available. The goal of this project is to synthesize an mRNA vaccine to prevent HPIV, with initial focus on strain 3. mRNA vaccines represent a new way of vaccinating that are proving superior over DNA vaccinations and generally elicit better immune responses in vaccinees than protein vaccines as well. Here, viral RNA was extracted from HPIV type 3, reverse transcribed, and amplified for the two viral surface receptors HN and F proteins. cDNA was cloned into a T7 RNA polymerase expression system and testing for expression after RNA transfection is ongoing. As a comparison against traditional protein vaccines, the same cDNA was also placed into a baculovirus expression system for manufacture of recombinant proteins for vaccination. After verification of expression of mRNA in mammalian cell lines and purification of viral proteins from insect cell lines, the potential vaccines will be utilized in mice with eventual testing of their antibodies against viral neutralization in cell culture.

III.G.3 **Assessing The Growth Of Fusarium Virguliforme On Culture Media Amended With Crop Residues**

**Presenter:** *Cristian Olmos*, Microbiology

**Mentor:** Leonor Leandro, Plant Pathology and Microbiology

**Abstract:** The US is the world leader in soybean production, however every year billions of dollars are lost to soybean diseases. One of the most damaging is sudden death syndrome (SDS), caused by *Fusarium virguliforme* (Fv). Researchers suggest that corn-soybean rotation may not be a good method of controlling SDS, because corn is an asymptomatic host of the fungus, and Fv can survive on corn residue. In this in vitro experiment we compared what parts of the corn and soybean residues are preferable for the fungus to survive. We used corn and soybean leaves, stems, roots, and corn kernels at full maturity. All residue parts were ground and added to the culture media. Each petri dish received one mycelial plug of Fv, and radial measurements of mycelial growth were taken daily for 10 days. After 10 days, spores were harvested and counted. We found that although many of the plant residues treatments had similar effect on Fv mycelial growth, corn kernels treatment resulted in more Fv spores than the other residues ( $P < 0.0001$ ). This information can be used to better understand the contribution of corn kernels on pathogen buildup in fields in order to recommend best practices to manage SDS.

Session III.H  
1:00 – 2:15  
Gallery Room

## ENVIRONMENTAL SCIENCE

**Faculty Moderator:** *Laura Merrick*, Agronomy

III.H.1 **Late Quaternary Fire and Hydroclimate at the Southern Limit of the North American Temperate Tallgrass Prairie.**

**Presenter:** *Jacqueline Galang*, Environmental Science

**Mentor:** Hannah Carroll, Ecology, Evolution and Organismal Biology

**Abstract:** Extensive research has been conducted on climate and vegetation during the Late Quaternary period in the North American midcontinent, but few records exist at the southern limit of the temperate tallgrass prairie. The boundary between tallgrass prairie and the Ozark forest represents an important transition from northern to southern climate. Golden Prairie, Missouri is the largest and highest quality remnant prairie located at the tallgrass prairie-Ozark forest ecotone. A soil core was collected using a truck mounted hydraulic coring device. The core represents the entire soil profile of the site (~ 1.1 m) and provides an approximately 30,000 year record. The core was split and sampled for macroscopic charcoal and stable carbon isotopes at a 1 cm resolution. Stable carbon isotopes are a proxy for hydroclimate and plant community composition (C3 vs. C4), while charcoal occurrences provide a proxy for fire dynamics. The isotope record shows stable glacial conditions from the base of the record to ~ 25 kya followed by several prominent climate transitions during deglaciation into the Holocene. Evidence supports a cool/wet early Holocene with subsequent warming/drying during the mid-Holocene Climate Optimum followed by a slight cooling and wetter conditions into modern

climate. Additionally, the substantial modern decrease of  $\delta^{13}\text{C}$  is attributed to the 13C-Suess Effect. There is a complex, dynamic relationship between fire, climate, and ecosystems. We use a high-resolution charcoal record to understand patterns of fire, linking those patterns to regional climate via the carbon isotope record. Based on this evidence, fire dynamics have been closely coupled with climate change in this region.

### III.H.2 **Application Of Heat-Flow Modeling To Estimate Hydraulic Conductivity In The Ames Aquifer**

**Presenter:** *Thomas Doyle*, Environmental Science

**Mentor:** William Simpkins, Geological And Atmospheric Sciences

**Abstract:** Hydraulic conductivity (K) estimates in an aquifer are necessary to calculate recharge rates, groundwater velocity, and aquifer transmissivity. Several methods are commonly used to determine K, including permeameter tests of core samples, slug tests, and pumping tests. This project will test a method of K estimation using heat-flow modeling of groundwater temperature in part of the Ames aquifer. Data for the project were recorded using pressure transducers during the past 10 years from piezometer nests in the aquifer at River Valley Park near the South Skunk River and in the buried part of the aquifer below the Ames Municipal Cemetery. The South Skunk River loses water to the aquifer at River Valley Park and the temperature of the water as it leaves the river and is advected into groundwater in the Ames aquifer is recorded on 15-minute intervals in seven piezometers adjacent to the river (depths between 8 and 93 ft). Groundwater temperature is also recorded in a 92-ft-deep piezometer in the aquifer, approximately one-half mile downgradient from the river. Previous work has shown nearly a six-month lag in temperature between the river and seven piezometers at the river. The time lag between the river and groundwater next to the river and between there and the cemetery will be simulated using a heat flow model that also estimates K. Values of K from slug and pumping tests will be compared to K values from heat-flow modeling to determine the best estimate of K value for the aquifer.

### III.H.3 **The Impacts of Diverting Water by Hand-Dug Channels in the Nile Watershed on Agriculture, Food Security, and Water Management in the Kamuli District of Uganda**

**Presenter:** *Hannah Baysinger*, Global Resource Systems, Environmental Studies, Spanish

**Mentor:** Emily Zimmerman, Horticulture

**Abstract:** The Nile River is a critical resource for farmers in the Kamuli District of Uganda because farmers divert the river's water to irrigate their crops and enhance local food security. This irrigation is valuable in the dry season by providing necessary water to grow crops; nonetheless, during the rainy season the irrigation channels over-flood, flowing into neighboring farm-lands. Their mitigation strategies are simple: create more drainage channels, which facilitates more flooding potential in neighboring fields and in subsequent seasons. This cycle leads to reduced crop yields and income, impacting local food security. Impeding climate change poses additional risks for these farmers, as rainy and dry seasons are projected to become longer and more severe. Flooding conditions threaten farmer livelihoods by flowing over and eroding roads, creating impassable conditions for market access and traders called, middle men, who trade directly on a farmer's land. Many farmers surveyed use slash and burn practices to clear natural vegetation, which may increase the area for flooding by decreasing available biomass that catches excess water. This cycle leads to reduced agricultural productivity and diminished food security, and negatively impacts soil quality. The purpose of this study was to determine farmer awareness of flooding impacts and farmer mitigation strategies to reduce flooding, and to evaluate the impacts of flooding on the production of commonly cultivated cash crops (e.g., maize, rice, sugarcane, and potatoes). I developed three surveys to investigate farmer's perceptions of water management and their economic priorities. I surveyed 41 rural farmers in 21 villages in the Kamuli District during the summer of 2018, half of which were associated with the Iowa State University—Uganda Program and the other half who were not. General trends from the surveys revealed that farmers are aware that water diversion for irrigation during the dry season results in flooding during the wet season, and no matter their involvement with the program or not, farmers behave the same. Working with farmers and continuing future research to identify suitable solutions to overcome this challenge could enhance food security in Kamuli.

### III.H.4 **Tracking e. Coli and Phosphorus Pollution in an Urban-Rural Watershed**

**Presenter:** *Colin Welk*, Environmental Science

**Mentor:** Laura Merrick, Agronomy

**Abstract:** There is an abundance of evidence to suggest that humans have dramatically altered - sometimes permanently - the hydrology of the landscapes that we inhabit. In Iowa, tile drainage, land-cover changes, and

urbanization have drastically modified stream and lake processes to suit human needs. This project, part of a larger research effort from the University Translational Research Network (U-TuRN) at Iowa State University, uses the small and rapidly urbanizing watershed of South Worrell Creek to examine human and natural factors controlling water quality with a particular interest in the dynamics of two of Iowa's most serious surface water contaminants: E. coli and phosphorus. The objective was to learn more about water quality dynamics, engage citizens, and bring together stakeholders and homeowners through the vital resource that connects us all: water. This was achieved through water sampling and testing, the use of GIS mapping and non-point source pollution estimation tools, as well as educational outreach. This study found E. coli concentrations well above state recreational water standards and that pollutants and soil were mobilized by periods of storm runoff from heavy rainfall, posing a threat to the newly constructed public park, the Tedesco Environmental Learning Corridor, and water quality further downstream.

## SESSION IV, 2:30 pm – 3:30 pm

Session IV.A

2:30 – 3:30

Cardinal Room

### CHEMISTRY

**Faculty Moderator: Joshua Peschel, Agricultural and Biosystems Engineering**

IV.A.1

#### **Structure and Synthesis of Rare Earth Ternary Pnictides**

**Presenter:** Brennan McBride, Chemistry

**Mentor:** Kirill Kovnir, Chemistry

**Abstract:** Ternary rare earth ternary pnictides have been studied since the eighties and various different crystal structures have been discovered, yet no properties have been reported. Tin, lead, and bismuth are being used as metal solvents at high temperatures to promote crystal growth. These solid-state flux reactions have been used in attempts to optimize the syntheses of these ternary phases, in order to measure their properties. Our reactions have led to a new crystal structure, LaSiP<sub>3</sub>, which crystallizes in P2<sub>1</sub>/c symmetry and is predicted to be a semiconducting material from electronic structure calculations. Unlike previously reported structures, such as LaSiA<sub>3</sub> and CeSiP<sub>3</sub>, this new phase is composed of alternating layers of La and SiP<sub>4</sub> tetrahedra, connected through edge sharing and P-P bonds.

IV.A.2

#### **Synthesis And Crystal Structure Of Novel AuGeP Compound**

**Presenter:** Juyeon Won, Chemistry

**Mentor:** Shannon Lee, Chemistry

**Abstract:** Ternary tetrel (Group 14) pnictide (Group 15) compounds have shown great diversity of crystal structure, as well as their optical and transport properties. Solid state methods have been used to explore the compositional phase space of the M-T-Pn (M = Ag, Au; T = Si, Ge; Pn = P, As) system for novel compounds that may expand the library of structurally unique materials. In the presented research, a novel compound of AuGeP has been synthesized and structurally characterized by single-crystal X-ray diffraction. This new phase adopts a monoclinic Cc space group with unit cell parameters of  $a = 7.184(3) \text{ \AA}$ ,  $b = 6.142(3) \text{ \AA}$ ,  $c = 6.141(3) \text{ \AA}$ , and  $\beta = 119.697(15)^\circ$ . Due to its non-centrosymmetric space group this compound may have potentially interesting optical properties. This compound is predicted to be a semiconductor with a bandgap of 0.3-0.5eV which has a potential as a thermoelectric material. More exploration is needed for this understudied system and current research is focused on synthetic exploration, optimization, as well as testing optical and transport properties of Ag or Au ternary tetrel pnictides.

IV.A.3

#### **Use of Image Quality Scores to Determine Fingerprint Age in MALDI Imaging**

**Presenter:** Madison Thomas, Chemistry

**Mentor:** Young-Jin Lee, Chemistry

**Abstract:** Fingerprint age determination is valuable to forensic investigations because of its relevance to crime instance. Previous research has established that ridges diffuse over time using subjective manual ridge measurements. As a more objective and quantitative approach, we suggest the use of image quality score as a measure of fingerprint age. This method is applied to matrix-assisted laser desorption/ionization mass spectrometry imaging (MALDI-MSI) and optical images. Two sets of fingerprints were collected for comparison, and aged zero, three, or seven days under ambient conditions. Fingerprints for optical comparison were

dusted with carbon development powder. Fingerprints for chemical analysis were coated with a sodium and gold matrix and analyzed using the MALDI-LTQ-Orbitrap Discovery. Images were aligned using enhanced correlation coefficient maximization (ECC) and compared using the structural similarity index (SSIM) algorithms to provide a quality score. Both chemical and optical images indicated diffusion over time. This was consistent with SSIM quality scores, which consistently decreased over time for each set of images. Future work will utilize shorter time points, the creation of a quality score calibration curve for fingerprint age determination, and a comparison of optical and chemical image scores to find the best method for determining fingerprint age.

#### IV.A.4 **Ion Concentration Polarization In A Simple Paper Device For Tear Analysis**

**Presenter:** *Dorian Twedt*, Chemistry

**Mentor:** Robbyn Anand, Chemistry

**Abstract:** Ion concentration polarization (ICP) is an electrokinetic phenomenon brought about by selective charge transport, resulting in the controllable accumulation of charged species (ion enrichment) in one area, and ion depletion in another. Most applications of ICP have been demonstrated in the separation of charged and neutral species in the channels of a microfluidic device; we demonstrate the use of ICP for the enrichment of charged species in a simple, inexpensive paper device using a Nafion ion selective. We propose that ICP in a paper device can be used for a potential diagnostic tool in which, upon electrokinetic enrichment, inflammatory markers (proteins) in tear fluid characteristic of certain autoimmune diseases can be analyzed via electrochemical ELISA.

Session IV.B  
2:30 – 3:30  
Gallery Room

## AEROSPACE AND MECHANICAL ENGINEERING

**Faculty Moderator:** *Bella Kim*, Aerospace Engineering

#### IV.B.1 **Runtime Verification Benchmark Generation for MLTL Properties via SAT and SMT**

**Presenter:** *Josh Wallin*, Computer Engineering and Spanish

**Mentor:** Kristin Rozier, Aerospace Engineering

**Abstract:** As the complexity of autonomous systems increases, Runtime Verification (RV) has become a critical component in safety-critical domains. Ensuring the correctness of these components necessitates realistic system benchmarks (e.g., traces and upheld/violated properties), an area of research that continues to be lacking. Often, benchmarks are simply collected from running systems, an approach that is unsustainable when a large number of varied and nuanced benchmarks is required. To combat this lack of benchmarks, we implement a procedure for generating benchmarks automatically from input formulas specified in Mission-Time Linear Temporal Logic (MLTL). This allows for a “system-agnostic” approach, permitting the same benchmark generation tool to be used for a large set of systems. We compare our solution (using a direct Boolean SAT encoding) to the only other existing technique for MLTL satisfiability checking, an equivalent problem to benchmark generation. The novelty of this project is twofold. Firstly, it presents a unique and powerful approach to benchmark generation that has not previously been explored. Secondly, it combats the lack of explicit support by SMT solvers for temporal logics by providing an interface for checking properties specified in MLTL modulo theories. We also explore future work that would extend this technique to handle more expressive formal specifications.

#### IV.B.2 **Investigating Earth's Magnetic Field with a CubeSat Fleet**

**Presenter:** *Alex Scott*, Aerospace Engineering

**Mentor:** *Ossama Abdelkhalik*, Aerospace Engineering

**Abstract:** Earth’s magnetic field is an area of research that has only been experimentally measured relatively recently, and most depictions of the magnetic field aren’t even completely up to date. The more active equipment measuring Earth’s magnetic field means more recent and accurate data about one of our planet’s most powerful forces. Even though NASA has done missions doing this very idea, their budget is millions of dollars, and even NASA can’t cover all of Earth with their satellites. With the uprising of CubeSat availability, and recent technology outbreaks within the University of Iowa, this research will investigate the possibility of using CubeSats and a newly developed science payload to measure Earth’s magnetic field. Not only is this mission going to be practical in data collecting, it will yield new insights in satellite “fleet” missions, as this

mission involves multiple CubeSats. This preliminary research will be tested and used for further missions, with a goal of having a multi-satellite fleet mission that will be able to cover all of Earth's surface collecting data.

#### IV.B.3 **Autonomous Entry, Descent, and Landing (EDL) Guidance Strategies for a Human Mission to Mars**

**Presenter:** *Richard Hoobler*, Aerospace Engineering

**Mentor:** Dae Young Lee, Aerospace Engineering

**Abstract:** Human missions to Mars present a unique set of challenges, not the least of which is that these missions require vehicles whose large mass renders the use of parachutes inadequate to safely land on the surface of the planet while also minimizing the cost of propellant carried within interplanetary trajectories. In order to decelerate and land at a precise location, the mission design involves two phases: (i) Atmospheric Entry, where hypersonic entry dynamics plays a critical role in optimally and safely steering the manned vehicle towards the final landing, and (ii) Powered Descent, where thrusters enhanced by supersonic retro-propulsion technology are employed to bring the vehicle/lander to a safe landing at the desired location. The flight dynamics involved in these distinct phases are characterized by a distance from the center of Mars along with latitude and longitude specifying a position vector as well as speed with flight path and heading angles designating a velocity vector. Both phases require optimal autonomous guidance commands for control inputs to be generated. New guidance and control algorithms, which utilize trajectory optimization tools as well as the Model Predictive Control (MPC) concept, are being developed. The optimal bank angle and thrust profiles minimize the final landing velocity as well as error in the final landing location under the heat rate, aerodynamic load, and dynamic pressure constraints.

#### IV.B.4 **Gas-Turbine Performance Optimization Utilizing Surrogate Management Framework And Fluid-Structure Interaction**

**Presenter:** *Nikita Kozak*, Mechanical Engineering

**Mentor:** Ming-Chen Hsu, Mechanical Engineering

**Abstract:** The growing effort of the US Army's Future Vertical Lift (FVL) program calls for an efficient and effective tool that optimizes the performance of a proposed variable speed gas turbine engine (VSGTE). Traditional optimization methods like parametric sweeps require many iterations to arrive at solution, which is problematic in the application to gas turbine engines. Specifically, gas turbine engine analysis is completed by computational fluid dynamics (CFD) codes that feature high-fidelity models. These codes provide accurate results but are associated with a complex workflow, expensive computational cost and high dependency on designer interpretation and interaction when many iterations are completed. In a campaign to alleviate these shortcomings, a novel gas turbine engine optimization tool is proposed. This tool couples surrogate management framework (SMF) with a mathematical algorithm and computational model to explore the design space of system. For the designer, this tool provides a reduction in the number of required iterations resulting in a significantly faster, less costly and less complex optimization process that does not sacrifice accuracy. In this application, the gas turbine engine optimization tool is coupled with a novel FE fluid-structure interaction code to determine the optimal stator position, rotor position and operating speed of an Army gas turbine stage to meet FVL requirements. Potential gas turbine stage designs and the gas turbine engine optimization tool is presented to provide information on the design governing constraints and valuable insight on gas turbine stage concepts that can revolutionize propulsion systems.

Session IV.C  
2:30 – 3:30  
Oak Room

## FOOD SCIENCE AND HUMAN NUTRITION

**Faculty Moderator:** Don Beitz, Biochemistry, Biophysics and Molecular Biology/Animal Sciences

#### IV.C.1 **The Impact Of Compulsive Ethanol Consumption On Gut And Brain Neurochemicals**

**Presenter:** *Allyse Shoeman*, Nutritional Science

**Mentor:** Peter Clark, Food Science and Human Nutrition

**Abstract:** Alcohol abuse is a risk factor for a number of neurodegenerative and psychiatric disorders, such as Alzheimer's, Parkinson's, and depression, among others. Bi-directional communication between the central nervous system and the gastrointestinal tract (i.e. gut-brain axis) has been shown to influence host mood, and may contribute to disease pathogenesis. Therefore, acute alcohol abuse may alter neurochemical signatures in the gut that, in turn, influence changes in brain chemistry in manners contributing to the development or

protection against neurological and psychiatric disorders. We employed a mouse model of alcohol abuse, 'drinking in the dark', that promotes ethanol ingestion at pharmacologically relevant levels. Adult female and male C57BL/6J mice received free access to 20% ethanol (compulsive alcohol consumption) or water (control) for 2-4 hours during their active period over four consecutive days. On the fourth day, mice were sampled immediately after access to ethanol (or water) to measure gut and brain neurochemicals. Monoamine neurotransmitters, along with pre-cursors and metabolites, were measured using uHPLC in micro dissected brain areas and at different levels of the gastrointestinal tract. These data may provide insight into the etiology of neurological and psychiatric conditions related to alcohol abuse.

#### IV.C.2 **Nutritional Outcomes of Mothers and Children in a Community-Based Malnutrition Management Program**

**Presenter:** *Nyahon Both*, Dietetics

**Mentor:** Dorothy Masinde, Horticulture

**Abstract:** In 2018, 2.2 million Ugandan children were stunted (i.e., had a low height for their age). Research has shown that there is a decrease in stunting when a mother's educational level increases (USAID, 2018). This research compares the nutritional outcomes of mothers and caregivers with children under their care who are attending the Center for Sustainable Rural Livelihoods' Nutrition Education Centers (NECs) in the Kamuli District of Uganda. The NECs are community-based management of malnutrition program that provides participants with a supplementary meal and nutrition education. Anthropometric data of participants who have graduated or are currently enrolled was evaluated to determine the relationship between mothers or caregivers' nutritional status and the children's in order to determine its impact on management of malnutrition. We expect to see that the nutritional status of the current participants will improve, while those who have graduated may display a relapse in acute malnutrition. Mothers and caregivers with better nutritional status will likely have better nourished children. The future implications of this research will help determine long-term effectiveness of participatory community-based management of malnutrition. To maintain positive nutritional outcomes, increased access and availability of food and improved nutritional education of women of childbearing age can help in decreasing malnutrition. This research could also contribute data to update and reassess the status of malnutrition in Uganda, where food and nutrition policy was last passed in 2003.

#### IV.C.3 **Defining Dairy Consumption in Pregnant Women Living in Central Iowa**

**Presenter:** *Jessica Lundberg*, Dietetics

**Mentor:** Christina Campbell, Food Science and Human Nutrition

**Abstract:** Although the importance of calcium during pregnancy has been determined, the impact of dairy as a whole is more nebulous. The variety of nutritional composition between dairy sources and the uncertain definition of dairy contribute to the lack of concrete research in this area. This study seeks to evaluate and describe the current state of dairy intake in pregnant women to aid in defining dairy's impact on health. Data was extracted from second trimester three-day diet records of 123 pregnant women in previous Blossom Project studies. Dairy sources and serving sizes were evaluated and quantified according to MyPlate recommendations. Differences in dairy consumption was assessed based on Dairy Healthy Eating Index Scores. This study found the majority of women did not consume enough dairy to meet MyPlate recommendations and the percentage of dairy coming from milk was greatest in those who consumed the most dairy. Overall, 47% of dairy intake was milk and 40% was cheese. Those with medium and high dairy consumption group consumed more non-fat or low fat milk options rather than 2% or whole milk. To increase dairy consumption in women who are pregnant, an increase in milk consumption should be encouraged.

Session IV.D  
2:30 – 3:30  
Room 3512

## GENETICS AND MICROBIOLOGY

**Faculty Moderator:** Donald Sakaguchi, Genetics, Development and Cell Biology

#### IV.D.1 **Optimizing CRISPR interference for Conditional Gene Regulation in Malaria Parasites**

**Presenter:** *Ellen Meis*, Biology and Environmental Science

**Mentor:** Josh Beck, Biomedical Sciences

**Abstract:** To continue fighting malaria, identification of new drug targets or life cycle intervention points and a better understanding of malaria parasite biology are crucial. While the ability to genetically manipulate the parasite in order to assess gene function is key to this goal, the tools to study important parasite genes are

limited. CRISPR interference (CRISPRi) has emerged as a powerful and simple approach for conditional gene knockdown using enzymatically inactive Cas9 (dCas9). This project aims to develop and optimize a CRISPRi system in the most virulent human malaria parasite, *Plasmodium falciparum*, by determining optimal guide RNA design to achieve maximum target gene knockdown. To this end, we established a dual luciferase reporter system to test the activity of a tiled array of guide RNAs around the start codon of a gene target. We hypothesize that as the guide RNA location approaches the start codon, knockdown via dCas9 interference with transcription by RNA polymerase will increase. After determining the optimal guide RNA placement, the system can be used to screen putative transcriptional effector proteins to enhance knockdown. This system has the potential to provide a robust approach for studying essential *P. falciparum* genes with increased throughput. Current results will be discussed.

#### IV.D.2 **Recovery of Adult Neural Progenitor Cells from Alginate Hydrogels**

**Presenter:** *Laura Pesquera Colom*, Biology

**Mentor:** Donald Sakaguchi, Genetics, Development and Cell Biology

**Abstract:** The central nervous system (CNS) can be damaged due to trauma or neurodegenerative diseases. A diseased microenvironment can cause cell death, ultimately leading to loss of sensory and motor function. Cell transplant strategies have been used to introduce healthy cells into the microenvironment to aid in regeneration and CNS repair. To facilitate the survival of cells transplanted into foreign environments, hydrogels can be utilized as cell delivery platforms by providing a suitable microenvironment similar to the native extracellular matrix. Naturally-derived polymerized alginate hydrogels can protect cells when transplanted into external environments yet remain penetrable for the exchange of nutrients and waste making them ideal for use in cell transplantation. In this study, Adult Hippocampal Progenitor Cells (AHPCs) were incorporated into hydrogels in order to study the effect on the proliferation and differentiation of AHPCs. Cells were recovered from hydrogels after 4 days using a saline buffer and plated onto coverslips. Recovered cells were characterized using immunocytochemistry at 24 hours and 3 days post recovery with a panel of cell-type specific antibodies. The recovered cells had increased proliferation post incorporation into hydrogels while retaining the ability to differentiate into neurons and astrocytes. Transplantation of neural stem/progenitor cells within alginate hydrogels may provide a useful approach to enhance cell delivery methods and lead to the development of novel therapeutic applications for nervous system rescue and repair.

#### IV.D.3 **Investigation Of Cell-Seeded Gelatin Scaffolds As A Novel Cell Transplantation Strategy Using Zebrafish As A Model System**

**Presenter:** *Marissa Roghair*, Genetics, Microbiology

**Mentor:** Donald Sakaguchi, Genetics, Development and Cell Biology

**Abstract:** Nearly one billion people worldwide suffer from neurological disorders, including Alzheimer's and Parkinson's disease, traumatic brain injury, and others. These diseases and conditions result in a loss of cells in the nervous system, causing symptoms such as impaired motor and cognitive function. It is thought that replenishing damaged or lost cells could slow disease progression and facilitate recovery of function. Currently, cell transplants to treat these types of disorders often result in low cell survival and integration into the host tissue, providing little functional benefit to the patient. Biomaterials, such as gelatin scaffolds, have become an essential component of regenerative medicine, helping to aid in cell survival and incorporation while also being biocompatible and biodegradable. The goal of this project is to use gelatin scaffolds to deliver cells into the nervous system of zebrafish in order to investigate a novel therapeutic strategy for cell transplantation. Zebrafish serve as a biomedically relevant model system due to their transparency and quick development, allowing for visualization of the transplanted cells and biomaterials without requiring sacrifice. These scaffolds were seeded with glial cells isolated from the *Xenopus* retinal neuroepithelium. Cells were labeled in vitro with CellTracker CM-Dil, a red fluorescent dye, seeded into scaffolds, and implanted into the brains of larval zebrafish. Fish with implants containing visible Dil-labeled cells survived up to 5 days post-transplant. Ideally, this type of implant will provide an efficient means for cell delivery and for enhancement of survival for the cells during and post-transplantation. This project has implications for advancing current therapeutic strategies for those with neurological diseases.

#### IV.D.4 **Assessment Of Neural Stem Cell Proliferation And Migration For Regeneration Therapies**

**Presenter:** *Amy Stark*, Genetics

**Mentor:** Donald Sakaguchi, Genetics, Development and Cell Biology

**Abstract:** The central nervous system (CNS) is notorious for its inability for self-repair and regeneration. While flesh wounds heal and broken bones mend themselves, nerve cells in the brain, spinal cord, and retina cannot recover with the same efficiency. As such, there is an urgent need to investigate novel strategies to promote neural regeneration, and cell transplantation may be a promising solution. The purpose of this study was to develop a screening system to investigate neural stem cells that may facilitate cell-based regeneration therapies. As an initial step, an in vitro assay was conducted to study the proliferation and migration of *Xenopus* retinal neuroepithelium cells (XR1), rat adult hippocampal progenitor cells (AHPC), and mouse retinal stem cells (RSC). This project aimed to characterize the cell migration of each cell type grown on a variety of substrates including tissue culture polystyrene, two synthetic amino acid surfaces, and three extracellular matrix substrates. Comparison of these six substrates would identify optimal growth conditions for each cell type. Additionally, XR1 cells were pre-labeled with a fluorescent marker, CM-Dil, to be used for later identification of cells. CM-Dil-labeled and non-CM-Dil XR1 cell behaviors were compared to evaluate if the dye affects normal cell migration. This project contributes to the optimization of cell transplantation to repair CNS damage, facilitating the future of regenerative therapies for neurological diseases.

Session IV.E  
2:30 – 3:30  
Room 3558

## AGRONOMY AND ENVIRONMENTAL SCIENCE

**Faculty Moderator:** Brian Hornbuckle, Agronomy

### IV.E.1 **Are Yield Increases In Fertilized Biomass Crops Worth Reductions In Water Quality?**

**Presenter:** Tyler Donovan, Agronomy

**Mentor:** Emily Heaton, Agronomy

**Abstract:** *Miscanthus × giganteus* is a prominent biomass crop, but there is still much uncertainty surrounding its agronomy. While this perennial grass can provide low-carbon energy and products, biomass yields underpin economic viability of the supply chain. Previous research has shown *M. × giganteus* does not consistently respond to nitrogen (N) fertilizer, and that the crop is an excellent scavenger of soil N, thus keeping N out of water beneath the root zone, and improving overall water quality. However, past experiments exploring *M. × giganteus* often neglect the effects stand age and growing season can have, thus limiting inferences. There is also little water quality literature about fertilized stands of *M. × giganteus*, even though commercial stands are fertilized. We used a novel REpeated PLanting Year experiment (REPLAY) experimental design to see the interactive effects that stand age and nitrogen fertilizer have on *M. × giganteus* biomass yield and N leaching to water. This REPLAY experiment was a chronosequence experiment at three locations, each with randomized, replicated blocks of *M. × giganteus* planted in three consecutive years, to which five N rates were applied. Because the experiment has the same stand age occurring in multiple years, N rate, growing season, and stand age effects were separated and analyzed individually. We found N rate to effect biomass yield in 20% of observed years, stand age to effect biomass every year, and N leaching to be higher than previously observed. Knowing how N, stand age, and growing season effect yield and water quality becomes more important as more acres are devoted to growing *M. × giganteus* and a REPLAY design will help answer those questions.

### IV.E.2 **Investigation of Discrepancies between Methods of Quantifying Soil Nitrogen in Agricultural Fields**

**Presenter:** Christina Meadows, Environmental Science and Geology

**Mentor:** Michael Castellano, Agronomy

**Abstract:** Quantifying soil nitrogen in agricultural fields is an essential component of nutrient management for crop system production and environmental performance. Accurate and actionable soil nitrogen measurements are required to meet the Iowa Nutrient Reduction Strategy goals. The most common method for soil nitrogen measurement consists of shaking a soil sample in a concentrated salt solution for 30-120 minutes and measuring the concentration of nitrogen in solution. However, recent research questions the accuracy of this method for estimating plant-available nitrogen. Salt extraction can alter soil water status and disrupt soil structure, thus overestimating plant-available nitrogen. An alternative, but more laborious method, consists of directly suctioning soil solution and measuring the concentration of nitrogen in the solution. This method is thought to better represent the amount of nitrate that is available for plant uptake and loss to the environment. I hypothesized that salt extractions would produce consistently higher nitrate concentrations than lysimeters. Salt extractions did generally produce higher nitrate concentrations. However, there was no clear relationship between the concentrations of nitrate found in the soil solution and salt extracts. Therefore,

salt extractions may not be a suitable replacement for analyzing plant-available nutrients until the relationship between these methods is better understood.

#### IV.E.3 **Determining When Tillage or Crop Effects are Dominant to Make Satellite Soil Moisture Work in Iowa**

**Presenter:** *Luke Sloterdyk*, Global Resource Systems and Environmental Science

**Mentor:** Brian Hornbuckle, Agronomy

**Abstract:** This research aims to improve the measurements of soil moisture made by the NASA Soil Moisture Active Passive (SMAP) satellite throughout Iowa. Accurate SMAP soil moisture measurements will eventually be used to create more accurate predictive meteorology software. At present, SMAP measurements tend to be drier than soil moisture measurements that our team acquires via our on-site buried instruments, which we regard as “the truth”. Our hypothesis is that SMAP measurements can be corrected if we specifically treat the different effects of tillage and crops on the satellite signal. My role in this research has been analyzing 30 SMAP data points in Iowa. I look for dates each year where a parameter called the vegetation optical depth (VOD) is at a minimum in order to separate out changes in VOD that are caused by tillage from changes in VOD caused by the growth of crops. I will analyze these transition dates and explain why they change from year to year at each point and determine if there are any general trends.

Session IV.F  
2:30 – 3:30  
Gold Room

## POLITICAL SCIENCE AND MASS COMMUNICATION

**Faculty Moderator:** *Svitlana Zbarska*, Undergraduate Research program coordinator

#### IV.F.1 **#BlackBoyJoy: Visual Framing on Twitter**

**Presenter:** *Julian Neely*, Journalism and Mass Communication

**Mentor:** *Daniella Dimitrova*, Greenlee School of Journalism

**Abstract:** Mass media platforms play an integral role in communicating various beliefs, values and opinions throughout society. Social media is one way to promote and share narratives within communities of users. This pilot study examines how hashtags shape narrative creation on Twitter. More specifically, this preliminary research profiles how one hashtag – #BlackBoyJoy – has been used to communicate a positive and uplifting narrative surrounding Black boys and men. Using visual framing as the theoretical framework, this pilot study used content analysis to examine 200 tweets that contained the #BlackBoyJoy hashtag. Results offer perspective to understanding why #BlackBoyJoy became a social media phenomena and how narratives are constructed on Twitter. Preliminary findings suggest that hashtags can be used to challenge stereotypes and instead, empower and uplift users of social media platforms and society as a whole.

#### IV.F.2 **Examining and Analyzing Institutional Discourse on Twitter: Engaging Prospective Students**

**Presenter:** *Nayelie Valenzuela*, Public Relations

**Mentor:** *Daniella Dimitrova*, Greenlee School of Journalism and Communication

**Abstract:** Social media is where some of the largest communities of prospective college students and tomorrow’s leaders can be found. The Association of American Universities (AAU) institutions have begun utilizing social media platforms for interacting with past, current, and prospective students. As social media and technology evolves and becomes more accessible to users, the Association of American Universities (AAU) institutions search for innovative ways to not only reach out to prospective students, but to reel them in. How these institutions interact with prospective students has yet to prove effective. Building upon prior research, this study looks at Twitter, one of the leading social network apps in the United States and the readability and discourse that eight AAU-accredited universities use to engage their targeted audience. Readability levels were determined using MIT’s Flesch-Kincaid Grade Level Readability Test. Eight hundred tweets were analyzed, coded and scored from eight of the sixty AAU members in the United States to better understand their usage of the platform.

**Faculty Moderator: Jodi McGill, Veterinary Microbiology and Preventive Medicine**

- IV.G.1 **Evaluating The Efficacy Of Autonomous Recording Units For Fall Northern Bobwhite Surveys**  
**Presenter:** *Kyla Yuza-Pate*, Animal Ecology  
**Mentor:** Adam Janke, Natural Resource Ecology and Management  
**Abstract:** Avian point-count surveys have traditionally been used by ecologists to determine the distribution and density of bird species. With the advancement of audio technology, the use of autonomous recording units (hereafter ARUs) has gone up significantly to potentially replace humans in the field, including in fall covey surveys of Northern Bobwhites, a quail species that has a steeply declining population. However, there may be limitations to ARU use for quail surveys. Audio data collected in Ringgold Co., IA, from mid-September to mid-November in 2017 and 2018 was processed by three technicians to examine differences in call detectability and duration between observers, as well as the time of the call events in relation to sunrise and how call duration changes throughout the season at static locations. Results from this study may impact the specific use of ARUs in the future, as well as making processing methods for bobwhite audio more efficient.
- IV.G.2 **Understanding Interactions Between Avian Seed Dispersers and Landscapes: A Case Study of Guam.**  
**Presenter:** *Ethan Rose*, Biology and Animal Ecology  
**Mentor:** Hugo Thierry, Ecology, Evolution and Organismal Biology  
**Abstract:** Anthropogenic disturbances such as habitat loss and the introduction of invasive species have led to the extinction of numerous species throughout the world. Some of these species provided key ecological functions, and their extirpation has led to the degradation of their ecosystems. Thus, these systems should be of high priority for rewilding to restore ecological function. On Guam, all native avian seed dispersers have been functionally or completely extirpated due to predation by the invasive brown treesnake (*Boiga irregularis*). This has led to the degradation of native forests throughout the island. Restoring this ecosystem service is essential for the prevention of further degradation, and efforts to rewild Micronesian Starlings (*Aplonis opaca*) through range expansion are being considered. To understand the influence of population dynamics and landscape characteristics on small-scale seed dispersal patterns, we developed an individual-based model that simulates the behavior and life histories of the starlings, as well as their interaction with the different forest structures present on the landscape. In the model, data collected on Guam for the past 5 years is used to create a landscape in which starlings of different age classes move and disperse seeds according to observed patterns. We explored the influence of landscape configuration and composition on dispersal patterns and derived management recommendations for specific areas, taking starling population structure into account. This model can be used to inform future rewilding projects that aim to restore seed dispersal to degraded landscapes.
- IV.G.3 **Epigenetic Effects of Environmental Contaminants on Turtles with Temperature-Dependent Sex Determination**  
**Presenter:** *Victoria Villanueva*, Biology  
**Mentor:** Fredric Janzen, Ecology, Evolution and Organismal Biology  
**Abstract:** Turtles play vital ecological roles, such as mineral cyclers and indicators of health concerns like water contamination. However, they are among the most threatened vertebrate groups. Some turtle species exhibit temperature-dependent sex determination (TSD) where the temperature during embryonic development irreversibly determines sex, making them susceptible to small temperature changes. Moreover, many man-made chemicals and their breakdown of products in soil and water can act as endocrine disrupting compounds (EDC), chemicals that can interfere with the endocrine system, further skewing sex ratios. DNA methylation, an epigenetic mark suspected to play a role in TSD, also can serve as a biomarker of EDC impact. We investigated the interactive effects of temperature and EDC on epigenetic signatures involved in sex determination. Changing environmental conditions were simulated by applying chemicals (estradiol, control, fadrozole) to painted turtle eggs incubated at three temperatures (female-producing, control, male-producing) in a full factorial experimental design. Although all nine treatments produced both sexes, we found male-biased sex ratios for all treatments, with the exception of offspring from the fadrozole-treated and control eggs incubated at female-producing temperature. Blood and gonadal tissues were obtained from a subsample of these offspring five years after hatching to test the hypothesis that temperature and EDC persistently influence DNA

methylation levels and the TSD molecular mechanism. Although female turtles overall had less DNA methylation in their gonadal tissue than males, sex interacted significantly with chemical treatment to influence DNA methylation levels. These results characterize the complex interactive effects of human-mediated environmental changes at both the phenotypic and molecular levels in species with TSD. As many of these species are already in decline, this experiment can give insight on the viability of turtles in our rapidly changing world.

Session IV.H  
2:30 – 3:30  
Room 3505

## INDUSTRIAL ENGINEERING AND DESIGN

**Faculty Moderator:** Azadeh Sheidaei, Aerospace Engineering

IV.H.1

### **Analyzing Power Tools with an Ergonomic Perspective**

**Presenter:** *Christopher Hernandez*, Industrial Engineering

**Mentor:** Richard Stone, Industrial and Manufacturing Systems Engineering

**Abstract:** Frequently used by those in industry and by customers for side projects, power tools are responsible for getting a project done effectively and in a timely manner. However, continuous use of power tools can result in musculoskeletal disorders, hand and arm disorders such as carpal tunnel syndrome (CTS), tendinitis and vibration white finger (VWF). The purpose of this research is to create a method of evaluation through biomechanical and tool design analysis to develop more effective and user-friendly power tools that reduce the stress on the user's body. 19 male participants (average age of 23 and average height of 70.47 inches) were selected to make several cuts (overhead, neutral, and downward) using four different power tools across five different brands (brands A-E). The researchers collected data using Electromyography, VO2 max, vibration sensor, thermal sensor, force plate, and questionnaires (body-part discomfort and hand discomfort), while using a non-parametric method to analyze the data. As a result, Brand E required less time, participants perceived this brand to cut faster, and participants consumed less energy using this tool. In the future, it is suggested to experiment with the overall tool design to improve its usability and performance.

IV.H.2

### **Empathy in Design: How does diversity of personas affect creativity?**

**Presenter:** *Eric Diaz*, Mechanical Engineering

**Mentor:** Tejas Dhadphale, Industrial Design

**Abstract:** To determine when, and how, personas should be used we must fully understand the effect it has on creativity. In response to the increased attention to empathy in UX design and a more user-centered design (UCD) approach, researchers and practitioners continue to develop UX tools like empathy maps, personas, co-creation workshops, and journey maps. Design thinking methodology assumes that user empathy positively impacts creativity and leads to user-centered solutions. This study explores the relationship between personas, commonly used in design education, and creativity (quantity and uniqueness of ideas) to answer a two-part research question: Does the use of personas influence creativity and what aspect of the persona is most helpful for generating ideas? Thirty-six design students were randomly allocated across three conditions (single user persona, group persona, and no persona). Participants were given a design problem and the task to generate as many ideas as possible in twenty minutes. Ideation fluency was measured by counting the number of ideas generated by each participant. Originality or uniqueness was assessed using the Guilford's Unusual Uses Test. This will allow educators and practitioners to create personas that facilitate creative ideation.

# POSTER SESSION, 3:00 pm – 5:00 pm

Poster Session  
3:00-5:00  
Great Hall

## POSTER SESSION

### P.1 **Gait and Music EMG**

**Presenters:** *Callan Barrick*, Kinesiology, *Teagan Manus*, Kinesiology, *Marissa Koeppe*, Kinesiology

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** Gait impairment is among the major symptoms of Parkinson's Disease (PD) increasing the risk of falls and injury in this population, affecting both mobility and quality of life. However, current pharmacological and surgical treatments do not address this symptom. There remains a need to find alternative treatment strategies for gait impairment in persons with PD. Walking in time with an auditory cue, such as music, is a training intervention shown to improve gait function in persons with PD. However, research examining different techniques of optimal training parameters is lacking. The purpose of this study is to examine muscle activity as persons with PD walk with music. Participants completed three tasks, 1) walking without a cue, 2) walking with an auditory cue, and 3) walking with music. Electromyography (EMG) was collected from the tibialis anterior and gastrocnemius muscles. Peak EMG amplitude was determined and compared between conditions. We hypothesize that peak EMG amplitude will be greater for the walking with music condition. Results of this study will aid in determining alternative therapeutic options to improve gait impairment in persons with PD.

### P.2 **Analysis of Iowa Public Universities' Financials' Impact on Tuition Prices from 1990-2018**

**Presenters:** *Brandon Beecham*, Biology

**Mentor:** Diane Janvrin, Accounting

**Abstract:** Iowa public university tuition prices have been rising over the past few decades which has made education unattainable for those unable to afford the large price tags. The financial statements of the three Iowa public universities from 1990-2018 were analyzed. Our research found that yearly tuition and fees for an undergraduate resident, when adjusted for inflation, have increased by about \$5,100 – \$5,850 since 1990 while the undergraduate non-resident yearly tuition and fees increase has been around \$10,100 - \$20,500 depending on the university. Increased scholarship spending since 1990 has caused the tuition "sticker price" per enrolled student to increase by around \$2,660 - \$3,450. ISU and U of I have much lower state funding on a per enrolled student basis (\$5,920 and \$10,200 lower) and a per Iowa resident basis (\$10,300 and \$8,700 lower) than their 1990 inflation adjusted amounts; however, UNI's state funding has remained relatively unchanged. These factors and others have caused the average student's "true" tuition to increase causing financial strain for most Iowans; however, the increase in scholarship spending should disproportionately benefit those with financial need. If this trend toward rising tuition prices continues to increase, we could begin to see fewer students attending institutes of higher education which could negatively impact the future economic prospects of the state of Iowa.

### P.3 **Comparison of Cytokine Expression in Healthy Older Adults and People with PD**

**Presenters:** *Alaina Berg*, Biology, *Chirayu Shukla*, Biology

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** The causes of Parkinson's disease (PD), the second most common neurodegenerative disorder, remain largely unknown. Some studies have demonstrated altered levels of inflammatory cytokines (proteins secreted by immune cells for communication- including tumor necrosis factors (TNFs) and interleukins (IL-1b)) in persons with PD. This may imply a possible involvement of inflammatory and immune-mediated mechanisms in its pathogenesis. While these studies did show associations between inflammatory cytokine concentrations and PD, some specific individual inflammatory cytokines were found to be inconsistent between studies. The purpose of this study was to address the inconsistency in current clinical data regarding specific cytokine expression differences in persons with PD and healthy older adults by characterizing peripheral inflammatory markers. Blood samples were collected from patients with PD (N=31) and healthy older adults (N=15). A high sensitivity Multiplex assay was used to investigate a series of blood biomarkers- both pro-inflammatory and anti-inflammatory. Although not statistically significant, when compared to healthy older adults, specific

cytokines (GM-CSF, IFN-g, IL-10) were of higher levels in persons with PD. Furthermore, when compared to healthy older adults, there were lower levels of IL-13 ( $p = 0.07$ ) in person with PD. Overall, more data needs to be collected in order to firmly establish such associations. These results can further support the role of inflammation in Parkinson's onset.

**P.4 Exploring Wearable Technology: Prototyping of Solar Powered Book Bags**

**Presenter:** *Courtney Beringer*, Mechanical Engineering

**Mentor:** Eulanda Sanders, Apparel, Events and Hospitality Management

**Abstract:** The purpose of this study was to gauge public opinion on wearable technology and create a working prototype, with an extra focus on solar panel integration. Thus, the researchers gathered the information needed to develop a useful wearable technology product. This research is interdisciplinary between engineering and apparel design. Despite growing interest in wearable technology, the use of solar panels in commercial products seems to be non-existent. Companies have experimented with the integration of solar panels in clothing but have not been successful. This is due to multiple factors including aesthetics, efficiency, functionality, and price. This mixed method research design is composed of three phases: (a) a student focus group interview, (b) campus-wide online survey, and (c) prototyping. The collected data and textile testing guided the prototype design. The quantitative data was run through regression analysis to find themes around purchase intention. The textile testing included a water penetration test, an abrasion test, and a color fastness test. Materials included a flexible solar panel, a lithium ion battery, and electrical converters. The battery has USB and three prong ports, so it can charge a laptop which was one of the main needs of the survey respondents. The prototype provides an example to companies of a product that would likely take off in the market, because it was designed from consumer input. The results of this study contribute to bridging the gap between the product developers and consumers concerning wearable technology. This research is a continuation of previous work with solar powered book bag development including a sleeker design and electrical integration.

**P. 5 The Effects of Boxing Therapy on Upper Extremity Muscle Activity in Persons with Parkinson's Disease**

**Presenter:** *Thomas Berta*, Kinesiology, *Matthew Turk*, Kinesiology

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** Non-contact boxing is a current, trending alternative form of therapeutic physical activity for people with PD to target and improve their mobility, balance, and overall quality of life. However, there is little evidence available to support the efficacy of a boxing program on motor symptoms with PD. The purpose of this study is to examine upper extremity muscle activity before and after one session of non-contact boxing in people with PD, healthy younger and healthy older adults. Data was collected using wireless electromyography (EMG) sensors attached to the biceps brachii and triceps brachii of each participant. The participants were asked to flex and extend at the elbow joint under two different conditions: self-paced and fast-paced. Preliminary results demonstrated a decrease in peak EMG, time to onset, and time to offset. This may suggest that non-contact boxing increases muscle efficiency in people with PD. Future studies require a larger sample and inclusion of more functional movements to better analyze the effectiveness of a modified boxing program as an alternative therapeutic tool for people with PD.

**P.6 Helping Health Care Professionals Understand Social Support Communication Needs for Parents of Children Living With Complex Chronic Conditions**

**Presenters:** *Sydney Ellis*, Spanish and Psychology, *Nicole Miller*, Communication Studies

**Mentor:** Katherine Rafferty, Psychology

**Abstract:** More than 150,000 children in Iowa have special health care needs (University of Iowa, 2019). This means that approximately 2 out of 5 parents are tasked with the responsibility of caring for their medically complex child. This paper assesses these parents' social support needs. Parents were recruited from a pediatric and perinatal palliative care program from a large hospital in Iowa.

We used Charmaz's (2006) grounded theory to analyze 18 interviews where parents discussed helpful and unhelpful support received from medical professionals. Parents discussed three major themes characterizing helpful support: (1) emotional intelligence, (2) aggregation of social capital, and (3) empowerment through education. Collectively, these themes are categorized into a medical communication coordination model, which conveys the collaborative nature and equal significance of each theme. Our research lends

credence to programs like the Title V Maternal and Child Health Service Block Grant Program, Iowa's Pediatric Integrated Health Homes and current legislation surrounding the Affordable Care Act that affect parent and child medical support. This study shows the value of enacted support from medical professionals and further enumerates the need for legislation that allows medical professionals to support and equip an underserved population.

**P.7 A Climatology of Near-Storm Parameters for Nine Types of Tornado-Producing Thunderstorms**

**Presenter:** *Nathan Erickson*, Meteorology

**Mentor:** William Gallus, Meteorology

**Abstract:** My research has involved examining tornadic events reported from 2003-2017. The National Weather Service compiled a database of thousands of severe weather events that were reported in this time period, and my partner and I have analyzed the database in order to search for trends in meteorological parameters across various events. We have first organized the data into subsets, classifying by each reported storm type (Discrete, Cell in Cluster, Cell in Line, QLCS, Bow Echo, Cluster, Supercell RM, and Supercell LM) and then by time of the year (November-March, April-May, June-August, and September-October; these somewhat unconventional seasonal choices were determined by trends in tornadic activity). After creating these more specific subsets of data, we analyzed a variety of weather parameters relating to storm energy, wind, temperature, metrics, and other variables. We have then created plots of each variable for each type of storm, and we are currently working on analyzing the data based both on storm type and on time of year. As we continue to move forward, we will also analyze trends across storm type and time of year in the hopes of finding trends for both of these parameters. Finally, we hope to find correlations between specific weather parameters and the track length of reported tornadoes; if we are able to gain insight into storms that produce long-track tornadoes, our forecasting of these storms will be much better in the future.

**P.8 Co-creating Sketchnote Visuals with Honors Students**

**Presenters:** *Haley Grote*, Industrial Design, Pre-Design, *Mary Murphy*, Industrial Design, *Brandon Edwards*, Pre-Architecture, *Carolyn Driskell*, Pre-Graphic Design, *Annaka Ketterer*, Pre-Industrial Design

**Mentor:** Verena Paepcke-Hjeltness, Industrial Design

**Abstract:** This particular study is embedded in a larger research project, which focuses on one-on-one sketchnoting and how it affects student learning. Sketchnoting is a form of visual note taking that uses simple shapes, frames, and connectors to visualize complex information and concepts. The larger scope of the study analyzes how honors students can incorporate sketchnoting into their program of study. This often takes place in the form of lecture note taking, class reflections, and planning.

In a complementary approach our research specifically focuses on co-creating visuals for reflection sketchnoting. Often students become overwhelmed with their workload and forget what they are actually trying to achieve. Through weekly sketchnote reflections students have the opportunity to draw connections between their courses and reflect on what they have learned and accomplished within each week. Along with the reflections we will develop a visual library for each student. A previous study revealed that topic focused visuals support the conceptualization of ideas and comprehension of concepts. We will examine the difference between creating visuals alongside students versus creating visuals for students. Our evaluation of the two formats will focus on how actively participating in the creation of visual libraries affects students learning and general acceptance of sketchnoting. Over the course of eight weeks one-on-one and small group sketchnoting sessions will be conducted. During these times the focus will be on the co-creation of visuals and development of joint sketchnotes to meet the specific needs of the honors students. At the end of the study we will analyze each student's confidence in developing their own visuals compared to the beginning and the value of sketched reflections. The results will be further discussed in this presentation.

**P.9 Damage, Dislocation, and Displacement of Renter and Immigrant Households after Low Attention Disasters**

**Presenters:** *Ruben Hernandez*, Community and Regional Planning, *Emily Vanek*, Community and Regional Planning, *Jasmine Khammany*, Community and Regional Planning

**Mentor:** Sara Hamideh, Community and Regional Planning

**Abstract:** Natural hazards impact communities and people in disproportionate ways, and Iowa is no exception to this. The goal of the research we conducted in Marshalltown, IA after an EF-3 tornado was to examine the impacts of low attention disasters with respect to damage, dislocation, and displacement of renter and socially

vulnerable households. Marshelltown was extensively affected by an EF-3 Tornado on July 19th 2018, but was not a presidential-declared disaster until roughly two months after. Marshelltown has higher than average renter-occupied housing and immigrant community members for a small town. Research has shown that in events such as these, socially vulnerable and low-income neighborhoods tend to recover slower than more affluent neighborhoods. Our team conducted surveys on a random sample of 660 households and recorded structural housing damage in the tornado path from September to November. The preliminary findings of our analysis indicate that houses compared to other neighborhoods, especially renter-occupied houses, and despite lack of alternative housing options these neighborhoods had not made significant progress towards repairs, due to their limited access to financial recovery resources.

P.10 **Treatment to Reduce Potentially-Virulent Escherichia coli in the Gut and Prevent Avian Colibacillosis**

**Presenters:** *Ryley Hoven*, Biology and French, *Mary Kate Horak*, Dietetics

**Mentor:** Melha Mellata, Food Science and Human Nutrition

**Abstract:** Objective: Avian Pathogenic Escherichia coli (APEC) reside as commensals in the gut, but cause extraintestinal infections in chickens and other poultry. A factor that contributes to the colonization and virulence of APEC are iron-acquisition systems. To curb the spread of antibiotic resistant-pathogens, probiotics and live attenuated Salmonella vaccines (RASV) are prophylactic alternatives. Given that both are administered orally, we sought to determine if their use may alter extraintestinal virulence potential of E. coli populations in the chicken gut.

Methods: Fecal isolates were collected from four treatment groups of white leghorn chickens (n=3): without treatment (Group 1); fed probiotics (Group 2); administered RASV (Group 3), or a combination of both treatments (Group 4). For virulence phenotypic analyses, isolates were plated on CAS blue agar. PCR was used to confirm species (*uidA*), presence of siderophore receptor gene (*iutA*), and serum resistance gene (*iss*). Results: While groups 1-3 appear to have similar virulence phenotypes, Group 4 displayed decreased production of siderophores ( $p < 0.05$ ). Furthermore, Siderophore production was positively associated with the presence of *iutA* and *iss*.

Conclusions: Our combination treatment reduced the production of siderophores. Decreased presence of the *iutA* gene was also found in Group 4, strengthening our phenotypic findings. Decreased siderophore production and decreased serum resistance in chickens could contribute to decreased risk of APEC infection in chickens. Future work will seek to uncover how the combined treatments alter the virulence of resident E. coli in the chicken gut.

P.11 **Evaluating Criminal Punishments**

**Presenters:** *Lauren Hudachek*, Psychology, Criminal Justice and Anthropology, *Erin Izer*, Psychology

**Mentor:** Gary Wells, Psychology

**Abstract:** The United States criminal justice system is highly punitive. There is ample research to show that there tends to be harsher punishments for racial minorities, further exacerbated by racial stereotypes and perceptions. In contrast, the literature addressing the influence of other social factors on sentencing severity is more sparse. The current study seeks to measure the influence of racial bias when fact-finders (here, participant-jurors) evaluate criminal punishments. How does social background play a role how people assign punishment? If the individual looks like a regular, upstanding member of society, do they receive more lenient sentences compared to people perceived to lead unconventional lifestyles? To answer these questions, participants read eight brief descriptions of cases with mock offenders convicted of a Class D Felony. Case files provided information on the offender's ethnic background (European, African American, Asian, or Hispanic) and their social status (conventional, or not). Participants assigned a monetary fine and sentence length to each criminal case, and described up to five reasons for their decision. Race and social background should have independent effects on assignment of punishment, and interact to alter punishment decisions--if someone belongs to a racial minority and also leads an unconventional life, this will increase the severity of the punishment proportionately more than a European American who leads an unconventional lifestyle. In addition, a conventional lifestyle will benefit someone proportionately less when they are a racial minority with regard to how people assign punishment for their crimes. Finally, we may conduct exploratory analyses to see if the type of crime changes the punishment assigned for people where that crime is stereotypically associated with their ethnic group. These results may help explain some discrepancies in sentencing and speak to the attitudes and stereotypes that exist with respect to criminal activity in the United States.

- P.12 **The Role of Trust and Credibility in Public Understanding of Science and Attitudes Toward Scientists**  
**Presenters:** *Madelyn Huinker*, Communication Studies and Environmental Studies, *Katlyn Campbell*, Journalism and Mass Communication  
**Mentor:** Dara Wald, Journalism and Mass Communication  
**Abstract:** Trust is a critical component in public acceptance of science and scientific credibility. Without trust, scientists would struggle to effectively present their research to the public or encourage public understanding of science. While overall trust in science remains high, there remain important scientific topics with a lack of public acceptance of scientific evidence: extreme weather related to climate change, the safety of GM foods, the management of controversial wildlife. The purpose of this research is to explore how scientists in these contentious scientific areas communicate with the public and whether the strategies they currently use are effective in encouraging public understanding of science and trust for scientists. To answer these questions, this study uses pre- and post-surveys of audiences attending science-focused lectures. In addition, we use a pre-tested and validated rubric on science communication to evaluate scientific presentations and speakers. This study is currently being performed at Iowa State University, with plans to broaden our efforts to other universities in Iowa over the next semester. Analysis will be completed in Fall 2019. Preliminary results suggest that scientists are using effective methods to describe scientific processes but are not scoring high on audience engagement. This study will inform the literature on science and environmental communication by highlighting how scientists engage public audiences and how communication techniques influence audiences' attitudes and beliefs about controversial science topics and scientists.
- P.13 **Continuous Remote Attestation for Ultra-Low Power Processors**  
**Presenters:** *Shane Impola*, Computer Engineering, *Bradley Rhein*, Computer Engineering, *Dennis Xu*, Computer Engineering  
**Mentor:** Henry Duwe, Electrical and Computer Engineering  
**Abstract:** The trend towards embedding ultra-low power microprocessors in nearly everything poses a critical security challenge. Since the execution of software on these devices can have significant impact on human lives, verifying the software's integrity is a critical concern. Remote attestation is a security measure that allows a trusted party to verify the proper execution of these devices. In current attestation schemes, a trusted party, called the verifier, sends a challenge to an ultra-low power untrusted party, the prover. The prover must stop execution and perform a set of measurements using information from the challenge, then send the result back to the verifier who will determine whether or not the prover has been compromised based on the result. This approach to attestation is weak against transient attacks and requires the prover to halt its normal behavior, which can be problematic in a real-time or security-critical application. To address the weaknesses of current attestation schemes, this paper introduces a new type of attestation which we call Continuous Attestation. The communication bandwidth and overall energy requirement is significantly lower than current hardware-based attestation schemes when extending them for Continuous Attestation, while the hardware overhead is greatly reduced using techniques that we introduce. We trade-off the computation and communication overhead of the resource-constrained prover for increased computation for the verifier, accomplishing much of the energy savings required to implement such a scheme in an ultra-low power application. We evaluate a prototype by synthesizing an openMSP430 core with modifications, and develop a verifier prototype using a modified version of KLEE, an industry standard concolic testing tool. Continuous Attestation provides security guarantees to devices that didn't previously have them available, and future work will extend evaluations across a variety of applications.
- P.14 **On the Construction of a Gene Regulatory Network Database for Meta-Analyses in Boolean Canalizing Functions**  
**Presenters:** *Jack Kinseth*, Mathematics, *Haris Serdarevic*, Mathematics  
**Mentor:** Claus Kadelka, Mathematics  
**Abstract:** Gene regulatory networks (GRNs), frequently modeled using Boolean networks, describe how a collection of genes governs the processes within a cell. Boolean networks are intuitive, simple to describe, and yield qualitative results even given sparse data. The biological term canalization reflects a cell's ability to maintain a stable phenotype despite ongoing environmental perturbations. Accordingly, Boolean canalizing functions are functions where the output is already determined if a certain canalizing variable takes on its canalizing input, regardless of all other inputs. Due to their biological meaningfulness, this class of functions has

been hypothesized to be overrepresented in GRNs and used as an explanation for the observed stability of GRNs; however, published GRNs have never been properly evaluated to test this hypothesis. Using text- and data-mining techniques and PubMed, we generated an expandable database of published GRNs, and extracted the Boolean rules governing these networks. A meta-analysis of all extracted curated rules confirmed a strong overrepresentation of various types of canalizing functions. We further studied the relationship between network topology, stability and limit behavior and found significant differences when compared to random networks. This highlights how our continuously-expanding database represents a versatile tool for various meta-analyses.

P.15 **Lean Gestational Diabetes Mellitus Impacts Ovarian Gap Junction Protein Expression**

**Presenter:** *Avery Kornis*, Animal Science and Animal Ecology

**Mentor:** Aileen Keating, Animal Science

**Abstract:** Human parainfluenza virus (HPIV) is the second most common viral respiratory pathogen in young children. The virus causes symptoms such as fever, cough, and runny nose, and it has the potential to lead to more serious infection in the respiratory tract and often fosters secondary bacterial infections in the middle ears. Currently, there is no vaccine for HPIV or antiviral treatment available. The goal of this project is to synthesize an mRNA vaccine to prevent HPIV, with initial focus on strain 3. mRNA vaccines represent a new way of vaccinating that are proving superior over DNA vaccinations and generally elicit better immune responses in vaccinees than protein vaccines as well. Here, viral RNA was extracted from HPIV type 3, reverse transcribed, and amplified for the two viral surface receptors HN and F proteins. cDNA was cloned into a T7 RNA polymerase expression system and testing for expression after RNA transfection is ongoing. As a comparison against traditional protein vaccines, the same cDNA was also placed into a baculovirus expression system for manufacture of recombinant proteins for vaccination. After verification of expression of mRNA in mammalian cell lines and purification of viral proteins from insect cell lines, the potential vaccines will be utilized in mice with eventual testing of their antibodies against viral neutralization in cell culture.

P.16 **Manganese mineral pathways in aquatic settings and their use in determining conditions of an ancient lake on mars.**

**Presenter:** *Gabrielle Ledesma*, Geology

**Mentor:** Elizabeth Swanner, Geologic and Atmospheric Sciences

**Abstract:** Gale Crater on Mars contains sediments indicating a past lake environment. Based on findings by NASA's Curiosity Rover, operating in Gale Crater, the distribution of elements in the sediments are evidence of a redox stratified lake (Hurowitz et al. 2017). We are interested in data from the ChemCam instrument on Curiosity which showed up to 45 wt% manganese in individual Gale Crater samples (Lanza et al. 2014). Manganese enrichments can form in aquatic settings by several pathways. Knowing which pathway gives insight of past conditions on Mars. Mn-minerals can occur as manganese oxides, characteristic of a highly a oxic environment, or manganese carbonates, precipitated in redox stratified water conditions (Wittkop et al.). If manganese is precipitated as an oxide, it should be accompanied with distinct trace elements as Mn-oxides can easily adsorb trace metals.

ChemCam on Curiosity provides elemental data of samples collected in Gale Crater. Analyzing samples from lakes on modern-day Earth containing the minerals described above leads to further understanding of element associations of manganese minerals, which can be compared to the ChemCam data collected from Gale Crater. Samples from Lake Wentworth (MN, USA) and Lake Vermillion (NH, USA) both have presence of ferromagnesium crusts. Elements in these crusts have been quantified using x-ray fluorescent (XRF) and the mineralogy determined by x-ray powdered diffraction (XRD). Manganese carbonates in sediments from Brownie Lake (MN, USA), a redox stratified lake, have been made into thin sections under fully anoxic conditions. The thin sections will be imaged with secondary electron microscopy (SEM) and composite elements will be mapped using energy dispersive x-ray spectroscopy (EDS).

Quantifying manganese samples under various lake conditions allows for a more accurate picture of manganese mineral formations and associations. This provides a more in depth understanding of past conditions on Mars when a paleolake once existed.

P.17 **The Importance Of Creating Academic And Professional Environments For Multicultural Students In Agriculture**

**Presenter:** *Adamarie Marquez Acevedo*, Animal Science

**Mentor:** Elizabeth Martinez Podolsky, Animal Science

**Abstract:** Multicultural students in agriculture are changing and pioneering the future of the industry and fields. This presentation will discuss some data and qualitative feedback received from students in the Animal Science department regarding their experiences and feedback about how instructors could have a substantial impact on their learning and professional success. This conversation looks to encourage instructors to continue investing in multicultural students, learn some strategies on how they can be supportive, and create inclusive classrooms. From this presentation, we hope to initiate an introspective look upon agriculture fields in order to create spaces that foster multicultural student success.

P.18 **IL-17 Contributes To Disease During Mild Brsv Infection In The Neonatal Calf**

**Presenters:** *Paiton McDonald*, Agricultural Biochemistry, *Madison Porter*, Biology

**Mentor:** Jodi McGill, Veterinary Medicine and Preventative Microbiology Research

**Abstract:** Respiratory syncytial virus (RSV) is a leading cause of respiratory conditions such as bronchiolitis and pneumonia in infants and young children. Infected individuals experience a variety of symptoms which results in higher morbidity and mortality rates. Bovine respiratory syncytial virus (BRSV) is pathologically and immunologically similar to human RSV, therefore, this study serves as a practical preclinical model for testing therapeutic interventions on infected neonatal calves. Neutrophils are increased in the lungs of RSV infected patients and have been implicated in the pathogenesis of the infection. Interleukin-17 (IL-17), a master regulator of neutrophil recruitment; digoxin is a therapeutic pharmaceutical which has been shown to limit IL-17 expression. Blockade of IL-17 via digoxin treatment has been shown to reduce disease severity in murine models. Therefore, studies were undertaken to determine the impact of digoxin treatment on in-vivo IL-17 expression in the calf in order to determine its efficacy in reducing disease and virus-related pathology during RSV infection. Our results show that digoxin is efficacious in targeting IL-17 in the animal, and suggest that digoxin treatment reduces RSV-associated disease in the context of mild infection. However, IL-17 may play a beneficial role during more severe infection, suggesting a dose-dependent role for Th17 cells in the immune response to RSV.

P.19 **A 3D Printed Airbrush Nozzle Attachment for Investigating Shape Changes of Soft Biological Tissue**

**Presenters:** *Luke McPherrin*, Mechanical Engineering, *Sarah Hansen*, Mechanical Engineering

**Mentor:** Sarah Bentil, Mechanical Engineering

**Abstract:** The method used to produce speckle patterns, on soft biological tissue and soft material surfaces, is crucial to the success of three-dimensional (3D) Digital Image Correlation (DIC) experiments. DIC is a non-contact optical technique for obtaining the full deformation field of a specimen, due to an applied load. The speckle size, shape, contrast against the specimen's background, and unique pattern are all parameters that influence the accuracy of the displacement measurements. An airbrush, with a 3D printed nozzle attachment, is applied to generate repeatable speckles for DIC experiments. The speckles are quantified by considering the size of speckles generated and the density of speckle patterns using different airbrush attachment geometries. This research combines creative techniques from airbrush artists and technical methods from researchers, to analyze the effect of the airbrush nozzle attachment on the speckle pattern created. The proposed technique shows that repeatable speckle patterns are generated with the attachment, and the average speckle size can be adjusted by changing the height of the attachment.

P.20 **The Acute and Post-Acute Effects of Concussion Education on the Perceptions and Reporting Intentions of At-Risk Athletes**

**Presenter:** *Tessa Mendoza*, Kinesiology and Health

**Mentor:** Elizabeth Stegemöller, Kinesiology and Health

**Abstract:** A concussion is a type of traumatic brain injury caused by any bump, blow, or jolt to the head that disrupts normal brain function. Concussions can lead to headaches, altered cognitive functioning, and memory problems, among many other physical, emotional, and psychological symptoms. Previous studies have examined the physiological effects of sports-related concussions; however, limited research has studied the effects of concussion education for at-risk athletes. The purpose of this study is to examine the effects of education on current athletes' attitudes towards concussions and to determine the role of prior concussion history on athletes' reporting intentions. Self-reported subjective measures of athlete perceptions were obtained prior to, post, and three weeks following education and were compared to athletes who did not receive any education. We hypothesize that concussion education will lead to positive improvements in the

likelihood and confidence of reporting intentions in at-risk athletes. The results of this study will contribute to future educational opportunities for athletes and proper treatment of sports-related concussions.

P.21 **The Effects of Preferred Activating Music on Cognitive Inhibition**

**Presenters:** *Allison Meyer, Molly Norman, Emma Gettes, Cortney Elkin, Ella Gustafson, Jonathan Mennecke,* Kinesiology

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** The purpose of this study is to analyze the effect that preferred and non-preferred music will have on healthy young adults when performing the stroop cognitive task. Previous literature has found a link between style of music and cognitive function but there is no clear pattern for how music preference plays a role in cognitive inhibition. For some cognitive tasks, music led to poorer performance and in others it led to a better performance. The stroop task is a cognitive task that tests a participant's ability to filter out irrelevant stimuli. In our study, participants will complete the stroop task while their brain activity is monitored using EEG.

Participants will listen to either their preferred or nonpreferred study music during the task. These results will be compared to the participant's baseline results on the stroop task when no music was played.

We hypothesize that if participants listen to their preferred study music then they will demonstrate increased brain activity and lower completion times on the stroop task compared to performing the task while listening to non-preferred study music. Results of this study will give insight into whether one's preferred study music is truly beneficial to their cognitive performance. Future studies should examine whether musical experience serves as a confounding factor.

P.22 **What Matters More When Controlling Biologically-Available Carbon in Soil: Roots or Management?**

**Presenters:** *Jack Pieper,* Agronomy and Global Resource Systems

**Mentor:** Andrew VanLooche, Agronomy and Marshall McDaniel, Agronomy

**Abstract:** Soil organic carbon (SOC) is central to soil health and crop productivity, but only makes up 1-8% of soil mass. Of that small fraction, a still yet smaller fraction of total SOC is biologically-available to soil microorganisms. This small, yet critical, fraction of total SOC (sometimes referred to as labile C) has been shown to be highly variable and sensitive to climate, management, and other factors. Our objective was to determine whether management and proximity to corn roots (*Zea mays*) increased this labile C fraction. We hypothesized that increasing crop diversity and soil close to roots would have greater labile C. This hypothesis was tested in a 16-year crop diversity experiment located in Central Iowa comparing a 2 year rotation [corn-soybean (*Glycine max*)] with a diversified 4-year rotation [corn-soybean-oats (*Avena sativa*) & alfalfa (*Medicago sativa*)-alfalfa with cattle manure]. Soils were collected in the corn phase from both rotations at different proximities to the corn root: interrow, row, and rhizosphere. Overall, the rhizosphere soil had 36% greater labile C than soil from the interrow regardless of management. Unexpectedly, the diverse crop rotation decreased labile C by 34% regardless of how close the soil was to a corn root. This unexpected finding is not congruent with other recent studies that show conservation management practices, like crop rotations, increase labile C. More research is needed in order to determine the cause for reduced labile C under the 4-year rotation – including examining soil nitrogen dynamics.

P.23 **Visual Animation of a Spacecraft Detumbling Control Algorithm with JavaScript WebGL**

**Presenters:** *David Plotnik,* Aerospace Engineering, *Reed Kohlmeier,* Aerospace Engineering, *Sebastian Johansen,* Mechanical Engineering

**Mentor:** Ossama Abdelkhalik, Aerospace Engineering

**Abstract:** Many spacecraft attitude maneuvers are carried out using magnetic attitude control systems in small, low-Earth orbit satellite missions. A research group in the aerospace engineering department at Iowa State University have developed algorithms which optimize attitude maneuvers, such as the "detumbling maneuvers", in which a satellite stabilizes itself immediately after release from the launcher. Numerical simulators for these new algorithms were developed. These simulators generate spacecraft attitude data as a function of time during the stabilization process. We have been tasked with digitally animating the spacecraft's attitude in order to visualize the stabilization process. To display this animation, we have designed a JavaScript program that accepts the data generated by the MATLAB simulator. Then, the program employs WebGL, a JavaScript API that renders 3D graphics in a web browser window, to illustrate the optimized detumbling motion. Because the program only consists of JavaScript code in an HTML document, it can be easily shared with other researchers, and the program can be modified to fit different spacecraft design parameters. This will

allow these other researchers to illustrate the motion of their own spacecraft models and to better understand what the detumbling motion looks like.

P.24 **Developing a TRIZ-based Design for Flexibility Tool for Manufacturing Facilities**

**Presenters:** *Shibani Raje*, Industrial Engineering, *Jenna Oftedal*, Industrial Engineering

**Mentor:** Leslie Potter, Industrial and Manufacturing Systems Engineering, Gul Kremer, Industrial and Manufacturing Systems Engineering

**Abstract:** As manufacturers evaluate assets and long-term production plans, they struggle with how best to meet complex building requirements that maximize building flexibility and minimize costs. Research shows that manufacturers highly prioritize facility flexibility. However, infusing flexibility into facility design can be complex and achieving it can be costly. These issues could be mitigated with a dedicated tool for addressing flexibility in facility design. TRIZ (Theory of Inventive Problem Solving) is a problem-solving method that exploits information contained in millions of patents to identify solution genres and standard contradictions to drive inventive design principles. This user-friendly, decision support tool can efficiently reduce the complexity of incorporating flexibility into manufacturing facility design. Using this tool as a platform and incorporating information from fifteen case studies, construction-specific terms were mapped to TRIZ parameters and principles to create a construction industry specific TRIZ contradiction matrix. This paper describes basic TRIZ theory and previous uses in the construction industry. It then discusses industry input and case studies that helped make it construction-specific. Finally, it addresses the modified TRIZ tool's potential benefits to the construction industry regarding flexibility considerations.

P.25 **The Effects of Auditory Cues on Handwriting Kinematics**

**Presenters:** *Anna Reelfs*, Kinesiology, *Jamie Halbert*, Kinesiology, *Julia Hansen*, Kinesiology, *Jamie Stuhr*, Kinesiology, *Chloe Barton*, Kinesiology, *Nikki Latimer*, Kinesiology, *Ashley Miller*, Kinesiology

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** Previous research demonstrated music as an auditory cue can improve gait and reduce variability in fine motor movements in people with Parkinson's disease (PD). Limited research exists examining the relationship between auditory cues and handwriting. The aim of this study is to determine whether various types of auditory cues affect handwriting in healthy older adults and people with PD. Given that previous research suggests an improvement of motor performance with auditory cues, we hypothesize the presence of auditory cues will decrease variability in handwriting. Healthy young adults will be recruited for this study. Participants will be asked to write continuous cursive "l"s on a 1.5 cm lined paper for a total of 10 seconds in four conditions: self-pace, following a metronome, following activating music, and following relaxing music. The metronome and music will be set to a self-pace cadence using Pitch Switch. Participants will be randomized to complete three trials in each condition. Kinematic outcome measures of amplitude, velocity, inter-movement interval and associated coefficients of variability will be obtained from the position signal. We expect that music will reduce movement variability during handwriting. Results from this study will inform future research using similar protocol for healthy older adults and people with PD.

P.26 **Behavioral Differences in Cognitive Inhibition of Aging Musicians and Non-Musicians**

**Presenter:** *Kate Rumel*, Kinesiology, Pre-Health

**Mentor:** Elizabeth Stegemoller, Kinesiology

**Abstract:** Reduction in cognition, along with neurophysiological declines, occur during the aging process, specifically in inhibitory control. Studies reveal that older musicians have behavioral and neurophysiological enhancements in various cognitive domains as compared to their non-musical counterparts. Collectively, this research suggests enhancement and possible neuroprotection of inhibitory control (i.e. cognitive inhibition) among aging musicians. However, this has not been thoroughly studied. Thus, the purpose of this study is to: 1) determine differences in behavioral measures of cognitive inhibition in older and young adult musicians and non-musicians and 2) determine the differences in associated cortical activity measures of cognitive inhibition in older and young adult musicians and non-musicians. To measure cognitive inhibition, the Stroop task was performed and electroencephalography (P300 waveform) was recorded. Healthy older adult musicians and non-musicians and healthy young adult musicians and non-musicians were recruited for the study. Participants were asked to name the color of a word presented in either red, green, yellow, or blue. Three conditions were presented randomly: neutral (infrequent words sol, helot, eft, and abjure presented in different colors), congruent (color of word matches the word), and incongruent (color of the word does not match the word)

itself). The primary outcome measures for the Stroop task were average accuracy and reaction time. The primary outcome measures for cortical activity will be the amplitude and latency of the EEG P300 response. Pilot data reveal older and young musicians displayed faster reaction times in the Stroop task and a larger P300 amplitude at Fz (frontal area) than older and young non-musicians. The proposed study will provide a clearer insight of whether music experience contributes to increased inhibitory control in aging. Results will contribute to understanding and identifying strategies for designing accessible and evidence-based music interventions promoting cognitive health later in life.

- P.27 **Sensor-based Measurement of Engagement to Inform Industrial Engineering Pedagogy: Preliminary Work**  
**Presenters:** *Daniel Swegle, Jonah Scallon, Trevor Gould*, Industrial and Manufacturing Systems Engineering  
**Mentor:** Leslie Potter, Industrial and Manufacturing Systems Engineering  
**Abstract:** Technological and pedagogical advancements over the last three decades have significantly changed how students are taught in the industrial engineering classroom. However, changes in teaching do not necessarily equate to increased learning. How can we determine if classroom teaching methods and activities increase the engagement of students, which then may increase the amount of learning that is taking place? Research indicates that electrodermal activity (EDA) can predict engagement in a classroom setting. Assuming that students learn both better and more when they are engaged, we can use EDA to determine which classroom methods and activities are most effective. We measured students' EDA using Empatica E4 sensors in two different industrial engineering courses. Preliminary results indicate that we can correlate classroom activities and methods with student engagement. This paper describes our first steps for establishing a connection between EDA and classroom pedagogy, methods of data collection, results, and lessons learned. We compare our results to previously published literature and identify similarities and differences. This work provides a foundation for using EDA measurements to inform industrial engineering educators about increasing engagement, and consequently learning, in the classroom.
- P.28 **Mitigating Vibrations in Tall Buildings Under Extreme Wind Events**  
**Presenters:** *Abigail Van Rheenen*, Aerospace Engineering, *Michael Huntley*, Aerospace Engineering, *Paul Iman*, Mechanical Engineering  
**Mentor:** Alice Alipour, Civil, Construction, and Environmental Engineering  
**Abstract:** A major problem facing many tall structures is the effect of wind. Vibrations caused by wind conditions can severely damage both structural framing and non-structural components of the buildings and cause occupant discomfort. These adverse impacts can have significant economic consequences. This project aims to develop a smart morphing façade for the buildings which helps with decreasing the loads exerted to the building and decreases the wind-induced vibrations. The objective of this honors research program is threefold: i) to create a database of tall buildings in the US and assess the distribution of the building shapes along the height as an input to the analysis, ii) to analyze different aerodynamic shapes and aspect ratios of buildings using computational fluid dynamics modeling to determine best shapes that result in lower along and across wind vibrations, and iii) validate the outcomes with a series of wind tunnel experiments at ISU Wind Simulation and testing facilities (WIST). The data collected from testing will allow the team to determine and validate the impact aerodynamic shape and aspect ratio have on wind effects. This will show how to best optimize the shape of tall buildings to mitigate the consequences of wind.
- P.29 **An Experimental Design to Estimate the Number of Milkweed Plants Needed to Support Larval Monarch Butterfly Development**  
**Presenters:** *Elke Windschitl*, Animal Ecology and Biology, *Carolyn White*, Biological Systems Engineering and Global Resource Systems, *Kayla Wernsing*, Environmental Science and Geology  
**Mentor:** Steven Bradbury, Entomology  
**Abstract:** The eastern monarch butterfly (*Danaus plexippus*) overwintering population has declined over the past several decades. The decline is, in part, due to the loss of milkweed (*Asclepia* spp.) in the summer breeding range. Current milkweed abundance is estimated to produce ½ the number of overwintering adults needed to maintain a viable population. In 2014, the federal government set a goal to double the overwintering population. Therefore, restoration efforts must double milkweed abundance in the Midwestern United States. Better understanding of the relationship between larval development and milkweed abundance within habitat patches is needed to refine conservation practices. Currently, the number of milkweed stems needed to support the development of a monarch larva is uncertain. To inform an experimental design to

better understand milkweed requirements for development from egg to chrysalis formation, we observed monarch larvae provided 2, 3, or 4 stems of tropical milkweed (*A. curassavica*). Individual larvae (n=24) were placed on a stem in cages with a randomly assigned number of milkweed plants and monitored twice daily until larvae abandoned their natal stem of milkweed. At this time, larvae were collected, weighed, and larval stage was noted to analyze larval development. All leaves with evidence of feeding were collected, photographed, dried, and weighed to estimate plant material consumed. ImageJ software was used to calculate the consumed leaf area. Based on the mass and the unconsumed/consumed areas of the leaves, the dry biomass that each larva consumed was calculated. Results suggest the number of plants available to a monarch larva does not impact how long it remains on its natal stem, how much biomass it eats, or how many leaves it fed on. Definitive studies based on this initial experiment design using common milkweed (*A. syriaca*) are in progress.

- P.30 **The Relationship Between Finger and Toe Tapping in Persons with Parkinson's Disease**  
**Presenters:** *Ahmed Gamal Abdalla Zied*, Kinesiology & Health, *Cassandra Sardeson*, Kinesiology  
**Mentor:** Elizabeth Stegemoller, Kinesiology  
**Abstract:** Bradykinesia, slowness of movement, is one of the most common symptoms in Parkinson's disease (PD) Clinical evaluation for this symptom is done by assessing repetitive movements of the upper and lower extremities. Previous research done in our lab has shown that persons with PD demonstrate impairments in repetitive finger movements at rates close to and above 2 Hz (2 beats per second). However, it remains unknown if this same impairment is evident during repetitive toe tapping. Thus, the purpose of this study is to determine the relationship between repetitive finger tapping and repetitive toe tapping in people with PD. Participants completed a repetitive finger tapping and repetitive toe tapping at slow rates (<2 Hz) and fast rates (>2 Hz). Movement rate and movement amplitude were determined and compared between the two tasks. We expect that there will be a significant relationship between finger tapping and toe tapping in people with PD, especially at faster rates. These results will contribute to better clinical evaluation and treatment of people with Parkinson's disease.
- P.31 **Water Purification of Bacillus Subtilis Bacteria in Iowa State Water Sources Using Ceramic Filters**  
**Presenters:** *Karen Devora*, *Bryce Trpkosh*, *Hannah Jeffrey*, *Samual Sonius*, Civil Engineering  
**Mentors:** Kaoru Ikuma, Chris Rehmann, Civil, Construction, and Environmental Engineering  
**Abstract:** Third world countries are constantly in danger of harmful bacterias in their water sources. Previous methods for purifying water have included ceramic disk filters, which have been seen to effectively remove 92% of *E. coli* from contaminated water sources. However, limited research has been done to see the ceramic disk filters' effectiveness in removing other bacteria. We measured the ceramic filters' effectiveness to remove *Bacillus subtilis* from different water sources on Iowa State University's campus. We first began by collecting water from various sources around campus such as snow, Lake Laverne, College Creek and phosphate buffer created in the lab. Then, we infected the water samples with *Bacillus subtilis* bacteria and ran the water samples through a ceramic filter device. After running our tests we have concluded that the ceramic filter is effective at removing a predicted 92% of the bacteria from all water sources listed above.
- P.32 **Phage Discovery Lab**  
**Presenters:** *Jared Maas*, *Austin Becker*, *Martin Leyhe*, *Chenxi Li*, Microbiology  
**Mentors:** Nick Peters, Nancy Boury, Plant Pathology and Microbiology  
**Abstract:** Bacteriophage are viruses that specifically infect and kill bacteria. It is estimated that phages account for the death of half of all living bacteria on the planet every single day. Because of their ubiquity, phages can be found almost anywhere in the environment and be further isolated, purified, and studied. We set out to isolate and culture lytic phage from soil samples that specifically infect *Microbacterium foliorum*, a soil dwelling Actinobacteria. Following isolation and purification we used transmission electron microscopy to image our phage. We found a variety of interesting sizes and morphologies. Next, DNA was isolated from our phage and we used restriction digestion to help determine the quality of our DNA samples. Lastly, we submitted our phage isolates to the national repository and sent two phage DNA samples to the University of Pittsburg for genome sequencing. Given that phage can be used as an alternative to antibiotics for treatment of bacterial infections or ecological purposes, our phages can now be utilized by scientists worldwide for use in medical applications and ecological bioremediation with the potential to save lives and improve the environment.
- P.33 **The Effect of Deicers on Water Quality of Streams in Urban Areas**

**Presenters:** *Nicole Martindale, Jackson Manthey, John Feldmann*, Civil Engineering

**Mentors:** Kaoru Ikuma, Chris Rehmann, Civil, Construction, and Environmental Engineering

**Abstract:** College Creek in areas that vary in urbanization, starting upstream near the origin at a local park and ending where College Creek flows into a larger river. Within this range is the urbanized area of Iowa State University. The chloride level results over four different days of testing show that the further downstream (more urbanized area) the sample location, the higher the chloride concentration. Around 40% of our chloride concentration results per location are above the national drinking water standard of 250 mg/L. Variables such as the volume of water in the river or filtering the water samples are considered. The accuracy of the results are also affected by the range of chloride testing kits. One kit at 0-400 mg/L and another kit at 500-100,000 mg/L leaves a gap that eliminates precision. According to experimental results, the water quality of urbanized areas is greatly affected by the deicer applications. Therefore, alternative methods or solutions should be considered in the future to prevent negative environmental impacts.

P.34 **Annotation of Two Podoviridae Phage that Infect *Microbacterium Foliorum***

**Presenters:** *Karin Resendiz-Medina, Alex Beers, Seth Taylor, Faith Seggerman*, Microbiology

**Mentors:** Nick Peters, Nancy Boury, Plant Pathology and Microbiology

**Abstract:** In the fall semester, phages Alex44 and PhriedRice were isolated and purified from soil samples on the campus of Iowa State University and then sequenced by the University of Pittsburgh. Multiple annotation computer software systems such as: DNA Master, PECAAN, and Phagesdb, were used to predict the position of genes using algorithms formulated from known phage genome characteristics and other sources. During the spring semester our group took these sequences and sought to answer three specific questions: 1. Is it a gene? 2. Where does the gene start? 3. What is the function of the gene? We answered these questions by comparing multiple databases to ensure the validity of the results. In Alex44 we found a majority of genes had no known function, with one gene needing to be deleted. PhriedRice required deletion of several genes and a preponderance of genes with no known function. Our work during the spring semester corrects the approximately 10% error rate possible from the computer software systems' drafts of the phage genome. This work keeps mistakes from being amplified in other genome annotation projects, protecting the integrity of further research.

P.35 **Tracking Of Prominin 1 Gene During Zebrafish Development To Reveal Stem Cell Fate**

**Presenters:** *Maci Slaybaugh, Jessica Ivey, Julian Chrobak-Prince*, Genetics

**Mentors:** Jeff Essner, Allison Birnbaum, Genetics, Development, and Cell Biology

**Abstract:** Stem cells have the ability to differentiate into specialized cells forming vital organs, including the heart, lungs, skin, and other tissues. As an adult, bone marrow, muscle tissue, and other organs have the capacity to regenerate and repair damaged cells by using stem cells. Due to the regenerative aspects of stem cells, many medical advancements could be made. The gene Prominin 1 is expressed in stem cells and suppresses differentiation. By studying the Prominin 1 gene, we are attempting to locate stem cells within our model organism, zebrafish. We successfully transformed a Cre-loxP carrying vector to hold Prominin 1a or 1b, then purified and prepared the DNA for injection into Zebrafish embryos. With further research, we plan to insert an RFP-tagged Prominin gene into the embryo's genome. This should cause the stem cells within the adult fish to appear as a red color. This insert will allow us to track the lineage of stem cells in hopes for better understanding of their abilities within their specific tissues.

P. 36 **Effectiveness of Rubber Chips in Treating Stormwater**

**Presenters:** *Nicholas Streit, Josiah Crawford, Ote Albrecht, Jake Kraemer*, Geology

**Mentors:** Kaoru Ikuma, Chris Rehmann, Civil, Construction, and Environmental Engineering

**Abstract:** Stormwater runoff is a major concern in urban areas because it can pollute water bodies. Bioretention filters are a common way to treat stormwater, but extensive research has not been done to find the optimal filter media. One constituent that has potential to be effective is rubber chips. It is ideal because it is an abundant waste product and is inexpensive to transport. We expect that rubber chips will be an effective substitute for traditional biofilter media (sand, soil). Previous research has shown that rubber chips can be an effective part of a bioretention filter, but the implications of the study were limited as it did not measure the flowrate through the filter. The methods used for testing the rubber chips involve packing layers of rubber and traditional media (sand, soil) in tubes that are one meter tall with a diameter of 7.6 cm. Within that tube, the media is packed to be 50 cm tall. Standardized synthetic stormwater is poured into the tube, and the output

water is tested to determine how much of the pollutants were removed by the filter. Various combinations of rubber chips, sand, and soil were tested in our study. We expect our experiment to show that the rubber chip media will be a more effective filter to deal with flash floods compared to traditional media. We expect our rubber chip media to filter more pollutants and be more porous than the traditional media we tested it against. The higher porosity of the rubber chip media makes it a more desirable best management practice (BMP) in areas prone to having flash-floods. We expect the rubber chips will absorb more copper, organic carbon, and nitrates than traditional medias such as sand and soil.

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*Abstracts for the presentations at this year's Symposium are available on the ISU website:*

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