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# 13th Annual Research in the Capitol [Program], April 3, 2018

University of Northern Iowa. University Honors Program.

Iowa State University. Honors Program.

*See next page for additional authors*

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University of Northern Iowa. University Honors Program., Iowa State University. Honors Program., and University of Iowa. Honors Program.



Iowa Regent Universities present the

# 13th Annual Research in the Capitol

Tuesday, April 3, 2018

11:30am - 1:30pm

Iowa State House, Rotunda

Des Moines, Iowa



# Schedule

## 11:30am Opening Remarks

- Bob Kirby - Director, Iowa Center for Research by Undergraduates
- Student Speaker - Sarah Hofmeyer, University of Northern Iowa

## 11:45am-1:30pm

- Student Poster Presentations



# Welcome

Welcome to our thirteenth annual Research in the Capitol. In the last decade, over 500 undergraduates from our three Regent's Universities have come to the Iowa Statehouse to present their work to legislators, members of the Board of Regents, and the public. These students have gone on to contribute to our state as doctors, educators, engineers, lawyers, nurses, and professionals in various disciplines. The opportunity for our students to share their knowledge and exuberance with legislators, Regents, and guests in the Iowa Capitol is a special honor that has stayed with them across the years.

Research involvement plays a central role in undergraduate education. Students who take part in research are more successful academically, are more developed in their career and professional preparation, and are more satisfied with their college experience. Research engagement provides the conditions for collaborative learning and critical thinking that benefit our students as they move into the workforce or on to graduate or professional training. The presentations before you today required countless hours of effort on the part of the students and their mentors outside of the classroom and represent the shared commitment our students, staff, and faculty place on the undergraduate experience.

As you speak with these outstanding students, you will learn first hand the impact research involvement has on Iowa's students and the impact those students have on the research conducted at our outstanding Iowa Public Universities.



Robert Kirby  
Director, Iowa Center for Research by Undergraduates

# Iowa Regents Universities Contacts

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# Student Presenters

1. Lauren Anderson; Alyssa Hanken; Tessa Horn
2. Alexandra Bess – University of Iowa
3. Courtney Carstens – Iowa State University
4. Akanksha Chilukuri – University of Iowa
5. Jesse Cochran – University of Iowa
6. Nathaniel Collins – Iowa State University
7. Chandler Dolan – University of Northern Iowa
8. Benjamin Dralle – Iowa State University
9. Gabrielle Duncan- University of Iowa
10. Lindsey Floryance – University of Iowa
11. Callie Ginapp – University of Iowa
12. Adam Gjersvik – Iowa State University
13. Hannah Gulick – University of Iowa
14. Julia Hall – Iowa State University
15. Emily Hanson – University of Iowa
16. Cameron Hauser – University of Iowa
17. Brock Hefel – University of Northern Iowa
18. Kaelynn Heiberg; Rachel Maller – University of Iowa
19. Juliana Herran – University of Northern Iowa
20. Carolyn Hoemann – University of Iowa



# Student Presenters

21. Sarah Hofmeyer – University of Northern Iowa
22. Kathryn Holmes – Iowa State University
23. Diana Huisman – University of Northern Iowa
24. Myra James – Iowa State University
25. Nina Jovic – University of Northern Iowa
26. Alexander Karnish – Iowa State University
27. Kristian Hunter Kennedy, Katelyn Judson, Jaclyn Montour –  
Iowa State University
28. Megan Kennedy – University of Northern Iowa
29. Nikita Kozak – Iowa State University
30. Caeona Krivolavy – Iowa State University
31. Stephen Kruse – University of Iowa
32. Anna Larson – University of Northern Iowa
33. Michael Lashbrook – University of Northern Iowa
34. Colette Manley, Gabrielle Dirusso – Iowa State University
35. Courtney Massey – University of Northern Iowa
36. Sarah McMichael – University of Northern Iowa
37. Hailey Moore – University of Iowa
38. Sarah Mullen – University of Iowa
39. Timothy Nguyen – University of Iowa

# Student Presenters

40. Ashley Norem – University of Northern Iowa
41. Angela Olvera, Megan Helms, JeeYu (Keira) Choi, Monica Kettelson – University of Iowa
42. Kaitlyn Parrott – University of Northern Iowa
43. Chancey Petersen – University of Northern Iowa
44. Josh Prybil – University of Northern Iowa
45. Zane Satre – Iowa State University
46. Megann Schmidt – University of Northern Iowa
47. Skyler Schneekloth – Iowa State University
48. Morgan Smith – Iowa State University
49. Tanner Spies, Kevin Lin, Eric Spahr – Iowa State University
50. Lauren Swan – University of Northern Iowa
51. Kaylinn Taggart, Zachary Thielen, Laura Michaelson – Iowa State University
52. Isaac Tegeler – Iowa State University
53. Curtis Waltmann – Iowa State University
54. James Weatherly, Hannah Fisher, Matthew Lechowicz – Iowa State University
55. Ziling Xia – University of Iowa
56. Shao Yang Zhang – University of Iowa
57. Katherine Amick – University of Iowa

# Abstracts

## **1. Lauren Anderson; Alyssa Hanken; Tessa Horn – University of Northern Iowa**

Hometowns – Bettendorf, IA; Sperry, IA; Manson, IA

Majors – Teaching English to Students of Other Languages (TESOL); TESOL; TESOL and Spanish

Mentor – Tammy Gregerson

### **Positive Language Teaching: Culturally Responsive, Strengths-Based and Empathetic**

The three studies in this presentation examine the use of positive psychology (the study of what goes right in life) to benefit language learners. The first study examines the implementation of culturally responsive teaching by interviewing adult Chinese students and professors in the English for Academic Purposes program and in mainstream college classes. The interviews explored culturally responsive teaching and determined how students perceived and reacted to the lessons. The second study investigates the implementation of a personal strengths intervention to mitigate learners' foreign language anxiety and improve classroom performance. This study provided students with the opportunity to self-reflect and apply their strongest attributes to learning English and Spanish. The third study evaluates existing positive psychology claims concerning how to stimulate an individual's empathy by determining whether exposure to photographs of subjects—in this specific case, refugee learners—will increase the empathetic reactions of teachers toward them.

## **2. Alexandra Bess – University of Iowa**

Hometown – Saint Louis, MO

Major – Biochemistry

Mentor – Jennifer Fiegel

### **Protein-Nanoparticle Interactions of BALF with Various Polystyrene Nanoparticles**

In the sense of an aerosol-delivery drug mechanism, such as an inhaler, drug particles must travel through the airway to be absorbed by lung tissues before entering the bloodstream. This means that these drug particles must withstand barriers in the mouth, throat, and lung before taking effect. Bronchoalveolar Lavage Fluid is a saline sample of the proteins in a patient's lung fluid that a drug particle must break through before administering the drug to the bloodstream. Studying how these proteins interact with different types of model drug particles--variants of polystyrene nanoparticles--describes what these drug particles are up against in the last few steps of the aerosol drug delivery system.

### **3. Courtney Carstens – Iowa State University**

Hometown – Holstein, IA

Major – Journalism & Mass Communications

Mentor – Andrew Pritchard

#### **Is Facebook the New Phone Company? Common Carrier Law Provides a Transnational Foundation for Limiting the Power of Online Media Platforms**

Common carrier law offers the most promising legal and policy option for limiting the ability of social media sites, search engines, and other online media platforms to restrict communications or distort public discourse. The communication-enabling "platform" layer of the Internet requires a different balancing of policy goals than the more prominent debate over net neutrality at the level of broadband connections. If common carriage is carefully distinguished from the related but problematic concepts of free speech, public utilities, and economic monopolies, it offers an established body of law, accepted across many cultures and legal systems. These principles will allow online platforms with distinctive voices to maintain them, but also require services that promise open transmission of user content to live up to their promises. The increasingly global scale on which social media sites and other such platforms operate requires finding a basis for consistency across national laws and policies.

### **4. Akanksha Chilukuri – University of Iowa**

Hometown – Des Moines, Iowa

Majors – Neuroscience and Biochemistry

Mentor – Hanna Stevens

#### **Effects of Preeclampsia on the Brain and Behavior of Offspring**

Preeclampsia is a complication of pregnancy characterized by maternal high blood pressure and kidney dysfunction, as well as an increased risk for neurodevelopmental disorders in kids. For a better understanding of how preeclampsia affects offspring brain and behavior, we model it in mice. To do this, we expose pregnant mice to vasopressin (AVP), a hormone elevated in human preeclampsia that is sufficient to cause preeclampsia symptoms in mice, throughout gestation. Behavioral testing of the offspring of AVP-exposed mice exhibit learning and memory deficits, anxiety-like behavior, and hypersociability. Their brains are also different—they have decreased cortical volume during late gestation, on the day of birth, and as juveniles, though they recover by adulthood. We also examined microglia, the brain's immune cells which can regulate neuron proliferation, in embryonic offspring brain. The density of these cells is increased after AVP, which may explain other brain differences in AVP mice.

## **5. Jesse Cochran – University of Iowa**

Hometown – Newton, IA

Majors – Biology, Chemistry, and Biochemistry

Mentor – E. Dale Abel

### **The Protection and Recovery of Failing Hearts by a Ketogenic Diet in a MPC1 Knockout Model**

In the United States alone, 90 million Americans are afflicted with cardiovascular disease while another 800 thousand American lives are claimed annually by the disease, helping propel it to the number one cause of death worldwide. In order to maintain cardiac function, a healthy heart must utilize different substrates or fuel sources/ biomolecules flexibly. Metabolism is the process by which these different biomolecules can be interconverted, and energy can be produced or consumed. In order to study the link between metabolism and heart health, a genetic model, explicitly a mitochondrial pyruvate carrier knockout model, was generated to evaluate the connection between pyruvate accumulation and cardiac dysfunction. The mice used in this study manifested compensated and decompensated heart failure at the ages 8 and 18 weeks old respectively. Furthermore, ketogenic diet feeding was sufficient in preventing and restoring normal heart function within this heart failure model.

## **6. Nathaniel Collins – Iowa State University**

Hometown – Altoona, IA

Majors – Management

Mentor – Douglas Gentile

### **Does Compassion Predict Self-Compassion?**

The relationship between compassion and self-compassion is, as of yet, not fully explored. Previous research on compassion and self-compassion has sought to identify their relationship with mindfulness, yielding promising results. Additionally, compassion and self-compassion are often conceptually linked without identification of a direct relationship between them. This research sought to better understand their direct relationship as well as their relationship with mindfulness, by exploring the potential of compassion as a predictor of self-compassion. Does compassion predict the self-compassion aspect of mindfulness extraneous of mindful awareness? We predicted that compassion would predict the self-compassion aspect of mindfulness, but would not predict mindful awareness. Our study is based on the results of the Compassion Scale, the long-form Self-Compassion Scale, and Mindful Attention Awareness Scale (MAAS) completed by 476 students of a Midwestern university (mean age = 21.93, 41% male). Our research shows that compassion predicts self-compassion with moderate significance, when controlling for forgiveness. Additionally, mindful awareness was not predicted by compassion with any level of significance. The hypothesis of this research was partially supported by our findings, but further research is necessary to better understand the relationship between these variables. Further research should explore the relationship between compassion and other aspects of mindfulness.

## **7. Chandler Dolan – University of Northern Iowa**

Hometown – Lisbon, IA

Major – Biology

Mentor – Mark Myers

### **Bee and Butterfly Response to Floral Resources in Central Iowa Prairie Restorations**

Over 90 percent of Iowa's land is devoted to cultivated row crops and pasture, which has caused a decline in biodiversity and habitat for many bee and butterfly species. To restore lost ecosystems and conserve pollinator diversity, the USDA recently developed a new Conservation Reserve Program Pollinator Habitat conservation practice (CP-42). Since 2012, Iowa farmers have enrolled over 200,000 acres in this program with little evaluation of its effectiveness. In 2017, a team of students and faculty from the University of Northern Iowa and Tallgrass Prairie Center developed methods to evaluate vegetation and pollinator activity in CP-42 restoration plantings. Using this new protocol, we recorded over 300 individual pollinator sightings and 15 different species of butterfly. In 2018-2019, the team will evaluate pollinator habitat plantings on ~60 farms in central Iowa.

## **8. Benjamin Dralle – Iowa State University**

Hometown – Osage, IA

Majors – Nutritional Science and Genetics

Mentor – Lorraine Lanningham-Foster

### **Childhood Obesity Treatment in Iowa: Primary Care Providers' and Residents' Practices and Attitudes**

Childhood obesity is considered to be one of the greatest public health challenges of this century. Primary care providers (PCPs) have an important role in the assessment and treatment of children with obesity. The development of a healthcare provider's guide for childhood obesity treatment and its distribution throughout Iowa prompted a need to determine further resources to assist PCPs and medical residents in providing obesity treatment. The purpose of this study was to assess Iowa PCPs' and residents' current practices and attitudes with regard to childhood obesity treatment. PCPs and residents in Iowa were invited to complete a survey about childhood obesity-related treatment via email and in-person at educational events. Complete surveys were received from 47 PCPs and 14 residents. Data was analyzed using a modified jackknife process that compared data subgroups to the entire data set. PCPs were more likely than residents to provide counseling to patients on both general and specific weight-related behaviors. However, when residents do provide counseling, they are more likely than PCPs to use innovative counseling techniques. Residents were also more confident that Registered Dietitians can help improve outcomes for pediatric weight management. These findings suggest areas of focus for further research, educational efforts, and policy development.

## 9. Gabrielle Duncan – University of Iowa

Hometown – Waukee, Iowa

Majors – Human Physiology and Cell & Developmental Biology

Mentor – Gen Shinozaki

### Epigenetic Investigation of Military Sexual Trauma in PTSD and Major Depression

The disturbing reality is that many servicewomen in our military experience high levels of trauma during their service, not only from combat but also from sexual assault from fellow service members. In fact, over 40% of veteran women report being sexually assaulted during their service, around 10% of them resulting in posttraumatic stress disorder (PTSD) or major depressive disorder (MDD). In our lab at the Department of Psychiatry, we are exploring if epigenetic marks on DNA (DNA methylation) obtained from servicewomen are correlated with their exposure to sexual trauma. We are also investigating if such biomarkers are associated with risk for PTSD/MDD. Finally, we aim to identify DNA methylation changes predictive of treatment responses. Our goal is to find such an epigenetic biomarker that can identify individuals susceptible to PTSD/MDD, and ultimately predict treatment response so that the best treatment option can be selected for Veterans suffering from these conditions.

## 10. Lindsey Floryance – University of Iowa

Hometown – Muskego, WI

Major – Chemistry

Mentor – David Dick

### Exploration of Two Loop Loading Methods in the Synthesis of C-11 PIB: The "Al-luer-ing" Details

C-11 PIB also known as Carbon-11 Pittsburgh Compound B is a radioactive research compound used to image beta-amyloid plaques in the brain. It is often used in Alzheimer's research as a primary diagnostic imaging agent to detect these plaques. At the University of Iowa Hospitals and Clinics, C-11 PIB is used as an investigational compound to improve synthesis and characteristics of the radiopharmaceutical agent and compounds alike. In this study, a modification to the synthesis was tested to improve radiochemical purity and specific activity.



## **11. Callie Ginapp – University of Iowa**

Hometown – Mason City, IA

Major – Neurobiology

Mentors – Gordon Buchanan and Veena Prahlad

### **Understanding Sleep Apnea: How CO<sub>2</sub> causes arousal from sleep**

The ability to wake up from sleep in response to increased carbon dioxide (CO<sub>2</sub>) is a vital protective mechanism, as arousal from sleep restores muscle tone to the airway and allows for normal airflow when the airway is obstructed. This mechanism underlies obstructive sleep apnea- and although it is functioning properly-results in chronic fatigue. CO<sub>2</sub> induced arousal is thought to malfunction in cases such as Sudden Infant Death Syndrome (SIDS) and Sudden Unexpected Death in Epilepsy (SUDEP). This study shows that CO<sub>2</sub> induced arousal can occur independently of breathing- that an area in the midbrain can be directly activated to cause arousal from sleep in response to increased CO<sub>2</sub>. This area of the brain releases the chemical messenger serotonin in response to CO<sub>2</sub>, and future studies seek to investigate where serotonin acts in the brain to cause arousal from sleep in response to increased CO<sub>2</sub>.

## **12. Adam Gjersvik – Iowa State University**

Hometown – Altoona, IA

Major – Aerospace Engineering

Mentor – Peter Sherman

### **Faulty Turbine Blade Detection in the Time-Domain from Casing Pressure and Vibration Measurements**

It has been shown that measuring and detecting changes in the physical characteristics of gas turbine blades can be done with non-contact measurements during operation. However, nearly all of these detection methods are done in the frequency domain and require entire sets of measurement history data, which prevents the possibility of faulty blade detection in real time. This work explores the possibility of detecting changes in turbine blade natural frequency in the time domain from single turbine casing pressure and vibration measurements, and proposes a method for faulty turbine blade detection using a Kalman filter. The frequency content of the acceleration measurements is analyzed to construct a model of the turbine casing vibration signal, and it is shown that for the specific turbine used in the experiment, the power of some of the blade-passing frequency harmonics is increased when a simulated faulty blade is introduced. The Kalman filter is then successfully used to track blade-passing frequency harmonic amplitudes in the vibration measurements and detect when changes in amplitude occur, thus indicating a change in natural frequency of a turbine blade. These results present the possibility of on-line blade health monitoring of gas turbines.



### **13. Hannah Gulick – University of Iowa**

Hometown – Spirit Lake, IA

Majors – Astronomy, Physics, and Creative Writing

Mentor – Philip Kaaret

#### **HaloSat - A CubeSat in the Search for Missing Matter**

Everything visible in the universe is made up of normal, luminous matter known as baryonic matter. This baryonic matter makes up galaxies, the Earth, trees, and even your friends and family. It is the basis of astronomical and physical observations, but half of it is missing. It is believed this missing matter is in a huge, gaseous halo around galaxies. HaloSat is a CubeSat funded by NASA and built at the University of Iowa, that will launch in May of 2018 to look for this missing matter. HaloSat will go into orbit around the Earth and work to map the amount of matter in the Milky Way's halo to determine its shape and mass. This will yield HaloSat's scientific mission with a definitive answer; either there is an extended halo around the Milky Way Galaxy accounting for an enormous amount of missing matter, or there is not.

### **14. Julia Hall – Iowa State University**

Hometown – Council Bluffs, IA

Major – Marketing

Mentor – Stacy Cordery

#### **@FLOTUS: How Twitter Changed Our First Lady**

This paper analyzes the First Lady as a mass media creator and societal influencer who changed communication expectations through her use of Twitter. While many studies approach the first lady as an accessory to the president, I examine her as an independent agent in the national political process. Communication plays an integral role in perceptions of the First Lady. Throughout U.S. history, presidential wives such as Eleanor Roosevelt and Hillary Clinton revolutionized First Lady communication. Michelle Obama changed that field, not through newspapers or speeches, but rather through her profound use of social media. This study is based upon her @FLOTUS44 archived Twitter and other primary and secondary historical sources, using communication theory to investigate her use of Twitter to engage the public and further her agenda. This study concludes that Mrs. Obama achieved more seamless communication and reached more audiences than previously possible. She created new opportunities, while still acting within the recognizably traditional roles of mother, presidential supporter, and spokeswoman for her causes. Twitter and the First Lady have thus far been ignored by scholars, but in an increasingly technology-dependent world, the First Lady's presence on online platforms like Twitter is significant and can no longer be overlooked.

## **15. Emily Hanson – University of Iowa**

Hometown – Johnston, IA

Major – Communication Sciences & Disorders

Mentors – Inyong Choi and Shawn Goodman

### **Quantifying and Identifying Hidden Hearing Loss**

Recently, studies found that conventional hearing tests are failing to diagnose a critical form of hearing loss: the degraded ability to understand speech in background noise. This problem is referred to as “hidden” hearing loss (HHL) and is an emerging problem in the field of hearing science. The aim of this study was to find a way in order to quantify HHL. By doing so, we could identify the underlying physiology of this deficit and counsel individuals with this type of hearing loss. Audiological and neuroimaging techniques were used to define several neural processes required for successful communication in noisy environments and to promote our understanding of how processing deteriorates in listeners with degraded ability. It may be possible to develop interventions for HHL that can be used in a clinical settings with the results of this research.

## **16. Cameron Hauser – University of Iowa**

Hometown – Plymouth, WI

Major – Human Physiology

Mentor – Gordon Buchanan

### **Investigation into a role for locus coeruleus norepinephrine-containing neurons in CO<sub>2</sub>-induced arousal from sleep**

CO<sub>2</sub>-induced arousal is a vital protective mechanism involved in multiple diseases including obstructive sleep apnea (OSA), sudden infant death syndrome (SIDS), and sudden unexpected death in epilepsy (SUDEP). Serotonin (5-HT) plays a significant role in CO<sub>2</sub>-induced arousal, though the exact mechanisms are unknown. We hypothesize that dorsal raphe pH-sensitive 5-HT neurons project to and stimulate locus coeruleus (LC) noradrenergic (NA) neurons to signal higher-order brain regions to cause arousal. C57BL/6J mice (8-12 wks., male and female) were treated with LC NA neurotoxin DSP-4 (50 mg/kg i.p.) or saline (n = 6/condition). Mice were instrumented for electrical recording of the brain and neck muscles, allowed to recover, and arousal latency during NREM following gas exposure to room air (RA; 21% O<sub>2</sub>/79% N<sub>2</sub>) or CO<sub>2</sub> (7% CO<sub>2</sub>/21% O<sub>2</sub>/72% N<sub>2</sub>) was assessed. Increased arousal latency in DSP-4-treated mice would support the hypothesis of LC NA neurons as a downstream mediator of CO<sub>2</sub>-induced arousal.

## **17. Brock Hefel – University of Northern Iowa**

Hometown – Dubuque, IA  
Major – Political Science  
Mentor – Stanley Ebede

### **Effects of Mobil Food Pantries in Addressing Needs in Rural Communities**

Food insecurity is an emergent concern worldwide (Barrett, 2010; Campbell, 1991). On the other hand, food security serves as one of the major contributors to human needs. The purpose of the study is to understand whether receiving assistance from the Mobile Food Pantry addresses the needs of the residents in rural communities. Furthermore, this study identifies the needs that commonly minimize residents' access to food. Identified needs include the following: rent/mortgage, utility bills, medical bills, increased cost of food at grocery stores, unexpected expenses etc. The findings of this study highlight how Mobile Food Pantries increase residents' ability to pay other necessary expenses. In addition, this study highlights Mobile Food Pantry participants as an important demographic to consider when addressing food insecurity.

## **18. Kaelynn Heiberg; Rachel Maller – University of Iowa**

Hometowns – Minnetonka, MN; West Des Moines, IA  
Majors – Sociology and Ethics & Public Policy; Sociology  
Mentor – Sarah Bruch

### **Equity Implemented: A Research-Practice Partnership with the Iowa City Community School District**

In this project, we work with the Iowa City Community School District to improve the equitability of school experiences and outcomes for students. We begin by examining how 5th-12th grade students in the Iowa City Community School District perceive their school environments using an extensive survey that asks students about several aspects of their experiences. From this data, we assess the extent of disparities between students with different characteristics such as race, gender, sexual orientation, and parent education. We then facilitate a task force of students, teachers, and community members who consider several evidence-based recommendations to reduce these disparities. Finally, we evaluate the programs the district adopts to assess whether they are being effective in reducing the disparities in student experiences and outcomes. Evidence from these evaluations suggests some positive changes in teacher knowledge and awareness of implicit bias and restorative justice practices.

## **19. Juliana Herran – University of Northern Iowa**

Hometown – Cundinamarca, Bogota

Majors – Philosophy and Mathematics and Chemistry

Mentor – Pavel Lukashev

### **Effect of Fe substitution on structural, magnetic and electron-transport properties of half-metallic Co<sub>2</sub>TiSi**

In recent years, research on magnetic materials has been one of the most technologically appealing developments in materials science. Among other applications, magnetic materials are essential components of data storage and information processing in computer hardware elements, such as hard drives and random access memories. Here, we present a theoretical study of structural, magnetic and electronic properties of ferrimagnetic Co<sub>2</sub>Ti<sub>1-x</sub>Fe<sub>x</sub>Si ( $x = 0, 0.25, 0.5$ ), using density functional calculations. We show that the magnetic moment of Co<sub>2</sub>Ti<sub>1-x</sub>Fe<sub>x</sub>Si increases when Ti is substituted with Fe, consistent with experimental findings. Calculations also indicate that Co<sub>2</sub>Ti<sub>1-x</sub>Fe<sub>x</sub>Si remains nearly half-metallic for  $x \leq 0.5$ . The Curie temperature is enhanced due to Fe substitution from 340 K for Co<sub>2</sub>TiSi to 780 K for Co<sub>2</sub>Ti<sub>0.5</sub>Fe<sub>0.5</sub>Si. The change in Fe concentration is also found to affect the lattice constant. The predicted large band gaps and high Curie temperatures make these materials promising for room temperature spin-based electronics.

## **20. Carolyn Hoemann – University of Iowa**

Hometown – Iowa City, Iowa

Major – Ethics & Public Policy

Mentors – Sarah Harkness and Jennifer Haylett

### **Reproductive Healthcare Access for People Who Use Illicit Drugs**

This research investigates how people who use illicit drugs make decisions about seeking reproductive healthcare. Interviews were conducted with drug users in England to learn how a single-payer healthcare system -- in this case, the United Kingdom's National Health Service (NHS) -- affects people's ability to receive reproductive healthcare while using drugs. Barriers that prevented this population from receiving healthcare include stigma about addiction, lack of information about how to get medical services, and fear that social services would take away children if authorities knew that the parent was using drugs. In the United States, cost is a primary barrier to healthcare access for drug users, but participants in England did not have financial barriers because the NHS provides free care to all people.

## **21. Sarah Hofmeyer – University of Northern Iowa**

Hometown – Alton, IA

Majors – Political Science and Public Administration

Mentor – Chris Larimer

### **Attitudes on Education Policy in Iowa**

What are the downstream effects of funding decisions on education policy? To what extent do education majors at the University of Northern Iowa and teachers in Iowa understand current policy surrounding education in the state of Iowa? This project answers these questions through surveying both populations. This research also evaluates these groups' self-efficacy in teaching and affecting change through teaching or contacting their legislators. Results of this project have important ramifications for the future of statewide education policy and UNI College of Education's ability to educate students about policies that will impact them. Finally, this research is critical to understanding how funding decisions in Iowa's legislature has impacted education majors and current teachers in Iowa.

## **22. Kathryn Holmes – Iowa State University**

Hometown – Antioch, IL

Major – Environmental Science and Community & Regional Planning

Mentor – Grace Wilkinson

### **Evaluating the Effectiveness of Iowa's Lake Restoration Activities**

Iowa's lakes are an important component of the state's economy, as Iowans spend over \$1 billion annually to engage in Iowa's outdoor recreational opportunities. However, continually degrading water quality across the state has threatened both ecosystem health and the economic viability of the state's recreation sector. Initiated in 2006, the Lake Restoration Program was passed as a congressional response to improve water quality in the state. The law allocates funds for lake restoration and requires the Iowa Department of Natural Resources (DNR) to submit progress reports and results for projects supported by this legislation. While these reports provide qualitative details, there is little quantitative evaluation of the project's success. This project utilizes reports from the DNR to create a database that catalogs the details of each project with the goal of evaluating restoration activities from a water quality perspective. This database can also be used to examine the return on investment for state financing of Iowa's lake quality. This project particularly analyzes the effectiveness of in-lake restoration activities such as dredging, shoreline armoring, and dike structures.

## **23. Diana Huisman – University of Northern Iowa**

Hometown – Osage, IA

Majors – Biology and Biochemistry

Mentor – David McClenahan

### **Extracellular ATP Effects on Intracellular Actin Fibrils' Location and Characteristics**

Epithelial cells lining secretory units and ducts of bovine mammary glands perform an important role in regulating movement of various macromolecules and whole cells during normal lactation and mastitis. During mastitis, host and bacterial produced substances can affect the “barrier” function of epithelial monolayers. One potential component is adenosine triphosphate (ATP). ATP likely interacts with P2X7, a purinergic receptor, in mediating some effects associated with mastitis. Bovine mammary gland epithelial cell line, Mac-T cells, were examined for cytoskeletal changes as result of P2X7 interactions. Actin cytoskeletons were stained with phalloidin and effects were examined by fluorescent microscopy. Observable increase in actin fibril size was noted in ATP treated cells, and not seen in cells treated with P2X7 inhibitors prior to ATP exposure. Results indicate the possibility of ATP modulating epithelial cell function in bovine mammary glands, affecting the barrier function epithelial cells normally provide, through interaction with the P2X7 receptor.

## **24. Myra James – Iowa State University**

Hometown – Omaha, NE

Major – Mechanical Engineering

Mentor – Christopher Currey

### **Comparing the effects of restricting irrigation on diascia and lobelia growth and development**

Restricting irrigation can be a means for non-chemical growth control and resource conservation. There are a wide variety of spring bedding plant taxa and few species-specific reports of the effect of restricted irrigation. Our objectives were to quantify the effect of restricted irrigation on growth, quality, and water use of diascia (*Diascia barberae*) and lobelia (*Lobelia erinus*). Rooted cuttings of lobelia and diascia were individually planted into 11.4-cm-diameter petroleum-based plastic containers filled with a commercial peat-based soilless substrate amended with controlled release fertilizer, and grown in a glass-glazed greenhouse. Plants were provided with drip stakes connected to a capacitance soil moisture sensor-controlled irrigation system that maintained substrate volumetric water contents (VWC) of 0.20, 0.30, or 0.40 m<sup>3</sup>·m<sup>-3</sup> throughout the experiment. Five and six weeks after treatments were initiated, data were collected for diascia and lobelia, respectively. Data recorded and calculated included the time to flower, height (diascia only), diameter, shoot dry mass (SDM), and total irrigation volume, and water use efficiency (WUE). Based on the results of this study, restricted irrigation reduces water use for both species, but the effect on growth control varied between lobelia (insensitive) and diascia (sensitive).

## **25. Nina Jovic – University of Northern Iowa**

Hometown – Waterloo, IA

Majors – Biochemistry and Biology

Mentor – Robert M. Chin

### **Investigating Reactive Diruthenium Intermediates for C-H Bond Silylation Reactions**

Diruthenium complexes have been shown to effectively catalyze the cleavage of carbon-hydrogen bonds in benzene and pyridine to form carbon-silicon bonds. However, the catalytic cycle of these diruthenium complexes is still unknown. Two stable dimethyl diruthenium complexes were synthesized using  $\text{CH}_3\text{MgBr}$  and  $\text{CH}_3\text{I}$  with yields between 57-68% and protonated with Brookhart's acid and triflic acid. Protonation of the dimethyl diruthenium complexes resulted in promising reactive monomethyl diruthenium complexes, which have been tested as possible intermediates in the catalytic cycle.

## **26. Alexander Karnish – Iowa State University**

Hometown – Donahue, IA

Major – Biology

Mentor – Haldre Rogers

### **How Does Seed Dispersal Affect Population Growth?**

The importance of biotic interactions on plant population dynamics is understudied and relatively unknown. A plant species' life history can be organized into life stages (for example: seedling, immature adult, mature adult) each with different growth, fecundity, and mortality rates. The life stage with the greatest influence on a species' population growth rate varies by species and environmental context. One particular context that could affect population growth is the presence or absence of animal mutualists such as pollinators or seed dispersers. To measure the importance of seed dispersal for a plant species' population, an integral projection model will be created for *Carica papaya*, a short-lived tropical tree species. We will parameterize the model using data from a system with seed disperser mutualists present, and one in which they have been extirpated by an invasive snake. Sensitivity and elasticity analysis will be used to identify the life history stages that are most important for maintaining a growing population.

## **27. Kristian Hunter Kennedy; Katelyn Judson; Jaclyn Montour – Iowa State University**

Hometowns – Mason City, IA; Altoona, IA; Carlisle, IA

Majors – Interior Design

Mentor – Diane Alshihabi

### **Community Revitalization and Interdisciplinary Design: Rehabilitating Historic Buildings to Conserve Cultural Heritage**

Throughout the state of Iowa, small towns are declining in population due to insufficient employment opportunities. Without intervention to effectively stimulate economic development and lure younger generations back to these communities, the character of Iowa's traditional town centers and the cultural heritage embodied within them will be increasingly lost to history. This study is in response to an outreach request from Britt Group, a non-profit organization in Britt, Iowa, committed to repurposing the community's First State Bank building, a monumental neoclassical structure, dating to the early twentieth-century. Three Interior Design students from Iowa State University collaborated in an independent study to conduct research and develop conceptual plans for the rehabilitation of the building. Research methodologies included archival research, photographic analysis, client interviews, onsite analysis, architectural precedent studies in Clear Lake and Mason City, and the development of conceptual floorplans and renderings. Findings revealed the community's need for a formal dining venue, specialized coffee shop, public ceremonial space, and short-term lodging. Hence, conceptual plans include dining and ceremonial space on the restored ground floor and a bed and breakfast on the first floor. The use of knowledge to serve local communities demonstrates the students' commitment to civic responsibility and heritage preservation.

## **28. Megan Kennedy – University of Northern Iowa**

Hometown – Ogden, IA

Majors – Family Services and Psychology

Mentor – Elizabeth Lefler

### **Gender Differences in Sexual Assault and PTSD Stigma**

Sexual assault, a significant problem in our society, is experienced differently by male and female sexual assault victims. Stigma is frequently experienced by sexual assault victims and reinforced through media, culture, and rape/sexual assault myths, and influences the mental health problems victims face after assault, including Post-Traumatic Stress Disorder (PTSD). Overall, insufficient research has been conducted on the differing experiences of stigma based on gender and diagnosis. It was hypothesized that male sexual assault victims would elicit more stigma than female characters, and characters with PTSD would elicit more stigma than characters who are resilient. With 214 participants, partial support was provided for the hypotheses that male sexual assault victims elicit more stigma than females, and individuals with PTSD elicit more stigma than those who are resilient following trauma.



## **29. Nikita Kozak – Iowa State University**

Hometown – Urbandale, IA

Major – Mechanical Engineering

Mentor – Ming-Chen Hsu

### **Implementation of the Actuator Line Method in Finite Element Simulation of Wind Turbine Aerodynamics**

Finite element simulation of wind turbine aerodynamics demonstrates strong accuracy regarding turbulence modeling by using fine-scale solutions. These fine-scale solutions allow the simulation's algorithm to compute incompressible flows in a more precise manner, but require high computational resources. These computational costs place a limitation on the simulation's usage in wind farm simulations. The implementation of the Actuator Line Method (ALM) provides a possibility to improve finite element simulation efficiency and grow the understanding of the interaction between multiple wind turbines in specific regions. ALM consists of replicating the complex structure of a wind turbine and its force distribution with a set of lines to represent similar influence on the surrounding fluid. In other words, ALM will decrease the complexity and the amount of calculations regarding fluid dynamics by eliminating the necessity of a fine discretization around the wind turbine geometry. This study will focus on implementing the ALM by developing an algorithm that will replicate a wind turbine tower and its force distribution. This algorithm will enhance the computational efficiency and improve the functionality of the simulation. A comparison of the duration and accuracy of a fully resolved finite element simulation and one that utilizes ALM will be made.

## **30. Caeona Krivolavy – Iowa State University**

Hometown – Milford, IA

Major(s) – Child, Adult, and Family Services

Mentor – Amber Manning-Ouellette

### **Personal Perceptions of Destructive Leadership**

The proposed research is designed to understand how personal perceptions influence how business students identify destructive leadership. The focus of the study is on participants' reflections of previous and/or current destructive leaders, and will center on a mixed methods approach through survey data collection. The measure of personal perceptions will be perceived from what data emerges comparatively between participants based on the demographic intake form. Destructive leadership negatively influences followership and workplace investment (Schyns & Schilling, 2013), so the proposed study will seek to answer how personal perceptions influence how business students identify destructive leadership, and provide much-needed information on biases coloring how followers perceive the quality, or lack thereof, in a leader.

### **31. Stephen Kruse – University of Iowa**

Hometown – Burlington, IA  
Major – Biomedical Engineering  
Mentor – Gordon Buchanan

#### **Norepinephrine and Serotonin in Seizure-Induced Respiratory Arrest**

Epilepsy affects an estimated 3 million Americans and around 1/3 of these cases will not respond to treatment. A chemical messenger in the brain called serotonin is thought to prevent death through the recovery of breathing after the seizure by preventing seizure-induced respiratory arrest (S-IRA). Our study focused on norepinephrine, another chemical messenger, and the role it plays in prevention of S-IRA. We used pharmacological agents to manipulate levels of both serotonin and norepinephrine in mice. Mice underwent an artificial seizure while breathing was recorded. We found that an increase in norepinephrine reduced S-IRA and death while pretreatment with a norepinephrine blocker extinguished this effect. An increase in serotonin was not sufficient to prevent S-IRA and death in mice with depleted noradrenergic systems. These results support the importance of norepinephrine in recovery of post-seizure breathing and may be a basis for further studies involving norepinephrine in seizure.

### **32. Anna Larson – University of Northern Iowa**

Hometown – Indianola, IA  
Majors – Music Education and Theatre Arts  
Mentor – Matthew Weedman

#### **Much Ado About Gender: How Artists Express Feelings about Gender Discrimination through their Art**

Gender discrimination has been a theme throughout human history that never seems to end. We see this within religious texts, in accounts of honour killings, and now we have the stories of the #metoo movement. To deal with this issue, people often take to their craft to express their feelings. From the original Greek classics to the complexity of modern-day musicals to the abstract feelings of performance art and music, different forms of art are used to communicate the motif of gender discrimination. Much Ado About Nothing is one of William Shakespeare's statements about gender and the power of the slanderous word against women. This adaptation of the beloved comedy shows how the mindsets of yesterday influence the actions of today. Inspired by the works of Sophocles, Strindberg, Brecht, Riz Ahmed, Jerry Book, Sheldon Harnick, Joseph Stein, and others, this thesis is a study of how artists portray the theme of gender discrimination through their work.

### **33. Michael Lashbrook – University of Northern Iowa**

Hometown – Waterloo, IA  
Major – Biology  
Mentor – Mark Sherrard

#### **Nitrogen resorption in prairie biomass feedstocks with different diversity**

High-diversity mixtures of native perennial vegetation could be ideal biomass feedstocks for marginal farmland in the Midwestern United States. These feedstocks are highly productive and should require less fertilizer than the monoculture feedstocks typically used for biomass production. One factor that could alter the relative need for fertilizer between feedstocks is nitrogen (N) resorption (seasonal translocation of N to roots). In this study, we examined N resorption in switchgrass plants grown in feedstocks with different diversity (1, 5, 16, and 32 species). The low diversity mixtures contained only C4 grasses while the high diversity mixtures also contained forbs and legumes. Plants that produced an inflorescence had higher N resorption than plant that did not, regardless of feedstock diversity. By contrast, we did not detect differences in N resorption between feedstocks. Our results suggest that differences in N resorption will not compensate for faster N depletion in low-diversity feedstocks.

### **34. Colette Manley, Gabrielle Dirusso – Iowa State University**

Hometowns – Inner Grove Heights, MN; Middletown, DE  
Majors – Animal Science  
Mentor – Stephanie Hansen

#### **The potential of a novel technology to positively impact Iowa beef production**

In 2016 the Iowa beef industry generated \$6.3 billion in economic activity and supported nearly 33,000 jobs (ISUEO, IBC-127, 2017). Precision Livestock Production (PLP) is becoming increasingly important in Iowa agriculture. This involves the use of real-time technologies designed to communicate problems to producers quickly, such that they can make beneficial decisions regarding animal health and productivity. One example of PLP is the CowManager system, an accelerometer ear tag that collects real-time data on time spent by cattle moving about, consuming feed, and digesting feed, as well as ear surface temperature. The data can be accessed constantly through software on any smartphone. Because the system was originally developed for dairy cattle, research on effective use of this technology for beef cattle production is necessary. The CowManager tags have been used on eight beef feedlot research trials at the Iowa State University Beef Nutrition Farm in Ames, Iowa, since 2015. This research seeks to identify the effects of various nutritional treatments and management practices on animal behavior, making them applicable to everyday feedlot producers. By having accessibility to real-time digital information, a producer can make management decisions on feeding, detect illnesses earlier, utilize antibiotics more judiciously, and ultimately positively influence beef production in Iowa.

### 35. Courtney Massey – University of Northern Iowa

Hometown – Sioux City, IA

Majors – Biology and Biochemistry

Mentor – Jim Demastes

#### Biogeography of Southwestern Pocket Gophers in the Genus *Geomys*

Species status between closely related species can be difficult to discern. The southwest United States is home to several species of pocket gophers (*Geomys*), including the northern species, *G. arenarius* and *G. bursarius major*, and southern *G. bursarius knoxjonesi*. Current biogeographic hypotheses for this assemblage involve a population of *G. bursarius* using one of several potential colonization routes across the arid region between the Pecos River and the Rio Grande Valley, which led to isolation and the speciation of *G. arenarius*. My project tested three likely colonization routes using comprehensive geographic samples of the aforementioned pocket gopher species. Genetic sequences of the COX1 mitochondrial gene offer insight into the evolutionary relationships between the species and, when combined with geographic data, a story of colonization. A clear route has been mapped based on the genetic data, and further data has been compiled in support of the gophers' status as independent species.

### 36. Sarah McMichael – University of Northern Iowa

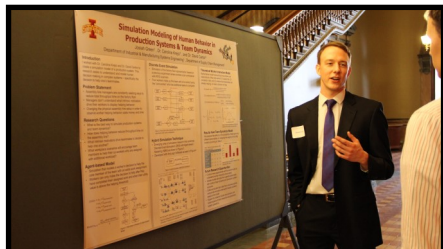
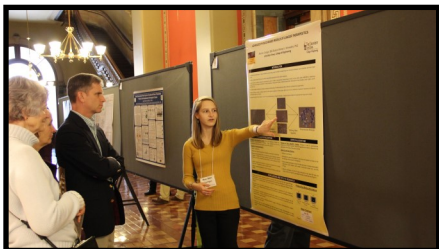
Hometown – Nashua, IA

Major – Biology

Mentor – Kirk Manfredi

#### Anti-fungal Compounds from Native Prairie Plants

Plant compounds can be found in many consumer products such as nutritional supplements (nutraceuticals), soaps, shampoos, and other personal care products. They are not yet used in these products as preservatives. This area of research focusses on identifying compounds from native prairie plants that can be used as preservatives in personal care products. An objective of this research is to isolate compounds that can be used to replace synthetic parabens. Synthetic parabens have been found to be harmful to humans and the environment. Our isolate would be a natural preservative and eliminate the harmful synthetic. This research presentation will discuss the anti-fungal compounds isolated from *Juniperus Virginiana* (a common conifer found throughout Iowa). The results of the isolation, structure elucidation, and efficacy of the antimicrobial compounds will be presented.



### **37. Hailey Moore – University of Iowa**

Hometown – Fairfax, IA

Major – Physics & Astronomy

Mentor – Cornelia Lang

#### **Polarization of the Radio Arc in the Galactic Center**

In the center of our galaxy, there is a structure known as the Radio Arc. In this Arc, there are linear filaments that are emitting radiation. These filaments have been observed at varying frequencies by the Very Large Array radio telescope in Arizona. This radiation is polarized along these filaments, and there are regions where the polarization is strongest. These regions are identified, and then later quantified. By comparing the values of the regions in polarization to the total intensity of all radiation in the filaments, we are able to determine what the fractional polarization of these regions are. Doing this will help us understand the structure and origin of the linear filaments, as well as help us to understand what may be causing areas of depolarization. We complete our work at two different frequency bands to help obtain a fuller picture of the structure as a whole.

### **38. Sarah Mullen – University of Iowa**

Hometown – Omaha, NE

Major – Microbiology

Mentor – Chris Stipp

#### **Shape-shifters: Do Melanoma Cells Change Shape to Evade Targeted Therapy?**

Melanoma, the deadliest form of skin cancer, arises from specialized pigment-making cells called melanocytes. In ~50% of cases, melanoma cells are found to have a DNA mutation in a gene encoding a protein called B-RAF, which normally switches on and off to control cell growth. The mutation causes B-RAF to be "stuck on", driving uncontrolled cell proliferation. Drugs that target B-RAF can temporarily block the proliferation of B-RAF mutant melanoma cells. Unfortunately, drug-resistant melanoma cells almost always emerge within approximately 6 months. Intriguingly, drug-resistant melanoma cells often have different cell shapes than drug-sensitive cells. Therefore, we study two proteins, Rho and Rac, that control cell shape. We found that targeting Rac can extend the period before drug resistance emerges in some, but not all, cases. We are now working to understand exactly how Rac is functioning and what other proteins it may be working with to promote drug resistance.

### **39. Timothy Nguyen – University of Iowa**

Hometown – Des Moines, IA

Major – Biology

Mentor – Songhai Chen

#### **Identification of novel tumor suppressors in breast cancer by an in vitro/in vivo genome-wide CRISPR screen**

Breast cancer is the most common cancer and the second-most common cause of cancer death in U.S. women. Despite diagnostics and treatment advances, advanced metastatic breast cancer remains incurable due to its developed resistance against treatments such as tamoxifen. The machinery driving tumor metastasis and the ability to nullify therapies remains largely unknown. To identify new molecular mechanisms assisting in the persistence of breast cancer, we performed an unbiased CRISPR-based genome-wide screen and identified a large set of genes. These genes, when silenced, could potentially confer tumorigenesis, metastasis, and drug resistance. Our recent studies have identified two of these candidate genes, NFKB1 and NEGR1, whose downregulation promotes breast cancer cell growth in vitro (cultured cells), suggesting that they may have tumor suppressive properties. This study aims to verify the function of these genes in breast cancer progression and response to drug treatment, both in vitro and in mice.

### **40. Ashley Norem – University of Northern Iowa**

Hometown – Urbandale, IA

Major – Movement & Exercise Science

Mentor – Jennifer Waldron

#### **The Effectiveness of Encouraging Habilitation in Adults with Wearable Activity Trackers**

The purpose of this study was to determine whether wearable activity trackers are effective tools to promote change in adult users. Individuals who wear activity trackers and also have been or are currently in physical therapy were interviewed to determine if the tracker and its features of goal setting, graphs, tracking mechanisms, and challenges motivated them to be more physically active, lose weight, or help them transition into a regular physical activity program that their physical therapist promoted. The three psychological needs of autonomy, competence, and relatedness were assessed in the interviews to determine if the tracker met these needs. The individual's use of different features on the tracker and how they use it daily was also assessed to determine how their motivation has changed since using the tracker. The information was used to determine if the tracker was an effective tool that helped the individual make a change in their level of physical activity.

#### **41. Angela Olvera, Megan Helms, JeeYu (Kiera) Choi, Monica Kettelson – University of Iowa**

Hometowns – Moline, IL; Downs, IL; Ulsan, South Korea; Plainfield, IL  
Majors – Biomedical Engineering  
Mentors – Bill Weaver and Vincent Rodgers

##### **Chew 'n' Play: Improving Children's Feeding Therapy**

25% of children are reported to have an eating disorder which affects their chewing ability and limits their nutritional intake. This percentage increases to 80% in children with developmental disorders. Feeding therapy can be applied to help these children gain muscular strength and increase tolerance of new foods. This therapy relies on the therapist delivering positive reinforcement in the form of videos and/or music to encourage the formation of good chewing practice. In order to improve the process of reward delivery, a device that can sense chewing motion in children is being developed. Once the device senses chewing, it will signal an application on an iPhone or iPad to play the reinforcement video. Ultimately, we are creating a way to immediately reinforce food acceptance during feeding therapy in children so that they successfully complete therapy in a timely manner.

#### **42. Kaitlyn Parrott – University of Northern Iowa**

Hometown – Cherokee, IA  
Majors – Biology and Biochemistry  
Mentor – Jeff Elbert

##### **Synthesis and Coupling Schemes of Naphthalimide Compounds with Target Drugs**

The target compound has three major parts, the naphthalimide core with tail, a linker, and the target drug. The target compound can be used for localized drug delivery by utilizing the photoactive properties of the core and a hydrolysis reaction in the body. Our research focused on the synthesis of target compound. There were two reactions schemes used during this research. The original scheme followed steps to synthesize the naphthalimide core with the tail and linker portion of the compound first, then it is coupled with the target drug. The second scheme, or modified scheme, was developed during this project to more effectively synthesize the target product. In the modified scheme, first half of the linker is attached to the naphthalimide core with the tail, then the other half is attached to the target drug, and finally the two halves of the linker are attached.

### 43. Chancey Petersen – University of Northern Iowa

Hometown – Ankeny, IA

Major – Geography – Guided Independent Study

Mentor – Andrew Berns

#### rtk4all: Implementing a Low-Cost and Accurate Positioning System

Global positioning systems are in many electronic devices for location based functionality. These systems yield position accuracy within 5 meters. Survey grade location information yield position accuracy within centimeters. Survey grade equipment costs tens of thousands of dollars to collect high accuracy location data. However, highly accurate data is crucial to utilizing imagery captured with unmanned aerial systems. This project introduces a low cost alternative to a survey grade system. By utilizing the open source library RTKLIB and electrical system design this project implemented a network of ground control points embedded with real time kinematic capabilities. These ground control points yield a position location with centimeter accuracy for a fraction of the cost. They also reduce survey time dramatically as surveying is done automatically after the points are in position.

### 44. Josh Prybil – University of Northern Iowa

Hometown – Solon, IA

Major – Chemistry and Mathematics

Mentor – Martin chin

#### Silylation of Pyridine and Pyridine Derivatives using Diruthenium Catalysts

Silylation of C-H bonds in pyridine can provide a building block that can be then used for further reactions. The reaction between pyridine and various silanes utilizes a diruthenium complex as a catalyst. This reaction is carried out at 160-180 °C with different diruthenium complexes with 3- silylpyridine as the main product (30-40% yield). The different effects of each diruthenium compound on the reaction will be presented. Reactions have also been done using pyridine derivatives and the percent yields and possible intermediates will be presented. The reaction products were isolated and fully characterized by NMR spectroscopy and GC-MS.





## **45. Zane Satre – Iowa State University**

Hometown – Ogden, IA

Major – Meteorology

Mentor – Tsing-Chang Chen

### **An Examination of Sudden Warming Events Associated with Cold Fronts in Iowa**

Abrupt temperature increases have been documented accompanying the passage of some cold fronts. These warming events can raise the temperature by as much as 4°C in mere minutes, and can sometimes last hours. Previous studies in Oklahoma, focused primarily on nocturnal periods, have indicated that these events are caused by strong winds associated with frontal passage mixing warm, elevated air down to the surface. This study examined front-associated warming events, both nocturnal and diurnal, at five airports in Iowa from 2014 to 2016. Strong warming events were found to be rare and restricted mostly to nighttime hours. Altogether, 11% of cold fronts during this period produced at least one warming event. Fall months recorded the most events, and had the highest frequency of warming. A coarse spatial analysis also found that warming events were more common in north-central Iowa. Comparisons between warming events and control periods revealed that warming generally occurred in the presence of weaker initial winds and stronger low-level thermal inversions. These results align with previous studies indicating that shallow inversions play a role in development of these events. Spatial analysis also suggests possible topographic influences, given the prevalence of warming events over Iowa's flatter, more open areas.

## **46. Megann Schmidt – University of Northern Iowa**

Hometown – Whittemore, IA

Majors – Biology and Biochemistry

Mentor – Pete Berendzen

### **Rates and Patterns of Evolution in a Duplicated Genome in the Family Catostomidae**

Whole genome duplication (WGD) is a process in which the entire genome of an organism is duplicated, making redundant genes which are subject to unique evolutionary forces. Various modes of selection create different genetic fates such as retention of ancestral function, development of new function, or loss of function. Because of these differing fates, WGD is hypothesized to be a major driving force behind diversification. In this project, DNA sequences from fish species in the family Catostomidae were examined to observe patterns of evolution following a known WGD. Gene trees were generated for 179 loci to determine the amount of divergence among duplicates, revealing divergence to be more common than conservation. Time calibrated phylogenies were generated revealing the date of initial duplicate divergence within the subfamily Ictiobinae to be approximately 63 MYA. Further analysis could reveal the evolutionary fate of each loci, providing insight into the ways WGD affects diversification.

## **47. Skyler Schneekloth – Iowa State University**

Hometown – Cedar Rapids, IA

Major – History

Mentor – Peter Orazem

### **Market Share Inequality in United States Agriculture**

This paper introduces a unique measure of farm size that incorporates market share, which enables us to visually illustrate economies of scale and the changing market shares of large and small farms. We evaluated the factors that explain variation in farm size from 1959-2012 across 48 states and 7 different crop markets using data compiled in the USDA Census of Agriculture. We find that farm size has grown fastest in states with the least population density, with relatively less educated farmers, and with lower urban incomes because better educated farmers who lived in proximity to urban areas where wages were higher used off-farm labor to supplement their farm income rather than increasing production. We also find that farm programs slowed the growth of farm size. Technology, profitability, and climate were also significant determinants of farm size. Cotton and corn farms have grown fastest, and fruit and tree nuts and tobacco farms have grown slowest. The farm size index shows a drastic increase in market share for the largest farms. In 1959 farms under 250 acres captured half of the aggregate market, but had retained only 10% by 2012. The paper will show different patterns depending on the crop.

## **48. Morgan Smith – Iowa State University**

Hometown – Nevada, IA

Major – Microbiology and Software Engineering

Mentor – Crystal Loving

### **The Effects of Raw Potato Starch on Salmonella Shedding in Weaning Pigs**

Salmonella is a common foodborne bacterium that can cause disease in animals and humans. Swine are a major reservoir of foodborne Salmonella and can experience weight loss, poor growth, or mortality if infected. Feed additives are increasingly studied for their effects as an alternative to in-feed antibiotics and for their potential to control Salmonella colonization in food-producing animals. Raw potato starch (RPS), when used as a feed additive, is fermented by cecal and colonic bacteria, producing short-chain fatty acids that inhibit pathogens, stimulate mucous production, and improve the colonic barrier. In this study, we asked if RPS when used as a dietary additive influenced Salmonella shedding in the feces of weaning pigs. 80 weaning pigs were transferred to the NADC and arranged into one group fed an RPS supplemented diet, and the other an unamended control diet. Fecal samples were taken periodically and cultured via enrichment. Selective media further refined bacterial populations, and agglutination confirmed final Salmonella presence or absence, not abundance. RPS showed promising results as a dietary supplement in reducing the incidence of Salmonella shedding in newly weaned pigs. Dietary supplements will be increasingly studied as a potential alternative to in-feed antibiotics.

## **49. Tanner Spies; Kevin Lin; Eric Spahr – Iowa State University**

Hometowns – Vinton, IA; Council Bluffs, IA; Cary, IL  
Majors – Industrial and Manufacturing Systems Engineering  
Mentor – Hantang Qin

### **Application of 3D printing to food preparation at Ames hospitals**

Studies have shown that malnutrition affects 20-50% of hospital patients. This lack of nutrition often stems from inadequate food intake which is associated with lack of food variety as well as insufficient flavor and texture. Hospitalized patients often have specific nutritional requirements that do not always align with their standards for appetizing and flavorful food. We are currently trying to solve this problem with the use of rapid-growing 3D printing technology. Current 3D printing technologies may be capable of preparing food with customizable nutritional values, flavors, and textures. The application of 3D printing to fabrication of hospital foods provides a new approach to fulfill each patient's nutritional needs while providing them with an enjoyable meal. Most of the food materials used in 3D printing are major crops of Iowa, such as corn or soybeans, and the byproducts of those crops, such as corn starch and soy protein. This project is focused on hospitals and nursing homes around Ames, and will be partially supported by the farmers of Iowa. The benefit will be seen by many, including those being fed in local hospitals and nursing homes and farmers whose crops will be used for this application.

## **50. Lauren Swan – University of Northern Iowa**

Hometown – Washington, IA  
Major – Spanish  
Mentor – Elise DuBord

### **La discriminación contra latinos (Discrimination Against Latinos)**

This study examines the types of discrimination Latin@ college students in Iowa face in day-to-day life. The study focuses on both covert discrimination (i.e. microaggressions) as well as direct discrimination. Based on the analysis of ethnographic interviews with 8 undergraduate students at UNI, Latin@s face discrimination in three primary ways. The first is due to people making assumptions about them. The second way is through exoticizing Latin@s. These types of discrimination are often not recognized as offensive or derogatory by the wrongdoer. Lastly, Latin@s are often the recipients of language-based discrimination. This form of discrimination has to do with the denigration of Spanish or perceptions about a non-native accent when speaking English. These discriminatory practices often have a lasting impact on Latin@s, including but not limited to fear of speaking their native language in public and being uncomfortable in public spaces due to their race or language.

## **51. Kaylinn Taggart; Zach Thielen; Laura Michaelson – Iowa State University**

Hometowns – Council Bluffs, IA; Bellevue, IA; Dakota Dunes, SD  
Majors – Architecture, Community and Regional Planning; Architecture;  
Mechanical Engineering  
Mentor – Ulrike Passe

### **A Mobile Diagnostics Lab for Interdisciplinary Climate Research**

The Mobile Diagnostic Lab (MDL) is an interdisciplinary research platform for implementing and analyzing building science utilizing the mobility of a trailer. The trailer is equipped with 120 thermistors and 8 relative humidity sensors throughout the space, allowing a 3D climate map to be generated. The trailer is complete with lights and heated floors. The back wall of the trailer was designed to be removable to allow different wall materials to be tested in the lab. Designed as a collaboration between multiple research groups, the lab is meant to function as a test bed for research topics including but not limited to: the effectiveness of different material assemblies, a controlled environment for computational fluid dynamics, and collecting urban micro-climate data in various locations. Through various modeling and sketching exercises using digital software, multiple options were explored. By utilizing this process in the design, factors such as spatial needs, research capacity, and budget limitations can be analyzed alongside each other. The mobile lab is finished with construction and is beginning its first research projects led by Iowa State University students. Our presentation will discuss more in-depth the construction process of the lab, its research capabilities, and experiments that will be implemented.

## **52. Isaac Tegeler – Iowa State University**

Hometown – Des Moines, IA  
Major – Computer Engineering  
Mentor – Lie Tang

### **Plant Localization with Deep Learning**

In current agriculture practices, weed control is an expensive and wasteful process that has negative impacts on the ecosystem. When using herbicides to control weeds, the whole field is sprayed. It will be beneficial to apply these herbicides to only the weeds in a field, because this kind of precision weed control approach will reduce chemical inputs to the crop production systems as well as the negative environmental impact caused by this important farming operation. To address this problem various machine vision systems have been developed to spot weeds and enable precision weed control. This has achieved limited success primarily due to insufficiencies of the weed detection system. With new breakthroughs in the machine-learning field created by deep-learning neural networks, we have started to embrace the latest deep-learning techniques such as Mask RCNN and FCN to recognize crops in images where fields are heavily infested with weeds. With the implementation of these deep-learning algorithms we are able to localize the plants (lettuce, broccoli) to pixel-level accuracy.

### **53. Curtis Waltmann – Iowa State University**

Hometown – Cedar Rapids, IA  
Major – Materials Engineering  
Mentor – Alex Travesset

#### **Capping Ligand Vortices as "Atomic Orbitals" in Nanocrystal Self-Assembly**

Nanocrystals (NCs) are nanometer-scale crystalline inorganic cores that have been capped with organic ligands. Assembling these NCs into materials that can perform new and potentially revolutionary functions is one of the central goals in nanotechnology. Our goal is to predict the periodic lattice structures or superlattices that these NCs self-assemble into. The OTM Model developed by my mentor, Alex Travesset, explains many of the experimentally observed lattice structures that were not previously understood. Central to this theory is the existence of capping ligand vortices. In my research, I use molecular dynamics simulations to analyze the interaction between two gold NCs capped with hydrocarbons. In these simulations, the existence of these vortex textures can be seen with the naked eye. I calculate pair potentials showing the binding energy and equilibrium separation between two NCs. This is performed on NCs cores 2-10 nm in diameter and ligand lengths between 9 and 18 in symmetric pairs. I also investigate NC pairs that are asymmetric and show that the symmetric case is energetically favorable. I then relate this back to the differences in vortex textures which occur in the asymmetric case.

### **54. James Weatherly; Hannah Fisher; Matthew Lechowicz – Iowa State University**

Hometowns – Lebanon, NH; Coggon, IA; Dyer, IN  
Majors – Community & Regional Planning; Agriculture & Society;  
Architecture  
Mentor – Kimberly Zarecor

#### **Quality of Life in Iowa's Thriving Small Towns**

Losses of population, jobs, and occupied homes are usually seen as signs of community decline. Current research shows that in rural communities such trends are unlikely to be reversed due to global shifts from a largely industrial to a postindustrial economy. With funding from the National Science Foundation, our interdisciplinary research team has taken up the question of how to help small communities protect quality of life as they shrink. Our research is innovative because many studies of rural communities focus only on documenting signs of decline or promoting uncertain growth strategies. We use an integrated research methodology that combines qualitative and quantitative methods from design, the social sciences, and data science to study shrinking Iowa communities where residents perceive that quality of life is stable or improving. We call these 'shrink-smart' towns. We will present results from the initial stages of our project, which included selecting communities to study, one-on-one interviews with residents, and creating detailed maps of towns and their regional networks at multiple scales. Our preliminary results suggest that these towns may be doing better than others because they are integrated into regional networks of services and community relationships that make them great places to live.

## **55. Ziling Xia – University of Iowa**

Hometown – Guangzhou, China

Major – Health and Human Physiology

Mentor – Gayle Walter

### **How to Improve Health of International Students in American Colleges**

In 2017, approximately 1.08 million international students studied in American colleges. Most of the international students came from Asian countries - especially China, India, and South Korea. Because of the culture shock of a new environment, many students experience challenges with language barriers, homesickness, and numerous health issues. Mental health issues, such as depression, anxiety, and suicidal ideations have stricken international students. Because of the stigma associated with mental illness, many students are reluctant to access campus mental health services. Health insurance plans for international students are very costly furthering limiting their choices in accessing health care. Culture competency, such as language, religious beliefs, and cultural practices, have a significant impact on international students' health. The mental and physical health of international students would be greatly improved by improving cultural competency and increasing access to affordable health care.

## **56. Shao Yang Zhang – University of Iowa**

Hometown – Bettendorf, IA

Major – Biomedical Engineering

Mentor – Justin Grobe

### **Clarifying the Neurobiology of Vasopressin Control: Role of Angiotensin AT1A Receptors on Magnocellular Neurons in Osmotic Homeostasis**

Arginine vasopressin (AVP) is a hormone generated within specific nuclei of the brain, which is secreted in response to blood loss and cardiovascular hormones such as angiotensin. AVP acts at the kidney to cause water retention, and on blood vessels to cause constriction - ultimately to retain blood volume and maintain blood pressure during cardiovascular insults such as hemorrhage or dehydration. Inappropriate increases in secretion of AVP are implicated in various blood pressure and fluid balance disorders. Thus, our team is working to understand the neurocircuitry that mediates the control of AVP secretion. Here we have utilized cutting-edge microscopy, genetic, surgical, and cardiovascular phenotyping methods to clarify the sites of action and functions of major angiotensin receptors in the control of AVP secretion. Insights gained inform our understanding of the neurobiology of AVP, which ultimately informs the delivery of care for hypertension, diabetes, obesity, obstetric and trauma medicine. is not.

## 57. Katherine Amick – University of Iowa

Hometown – Urbandale, IA

Major – Biology

Mentors – Edward Sander, Jan Fassler, and Craig Ellermeier

### Development of a 3-Hydroxypropionic Acid Biosensor

The iGEM (International Genetically Engineered Machine Competition team) project uses 3-HP responsive genes as switches for a reporter which 'programs' our bacteria, *Bacillus subtilis*, to express a unique color in response to the presence of 3-HP – molecule used create biodegradable plastics. This hardy bacterium has great potential as a 3-HP producer for industrial processes and metabolic engineering experiments. By modifying naturally occurring proteins with 3-HP sensitive genes in new organisms, we can tune our biosensor to be used for different purposes in research and industry. This collection of 3-HP responsive biological tools can also be used by future iGEM teams around the world, as we will package our system in biological packets known as Biobricks. Similar to Lego pieces snapping together, Biobricks can be easily incorporated into bacteria by other iGEM teams to build larger projects with an amalgam of these biological building blocks.



# Notes







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