



Iowa Regent Universities present the

# 18th Annual Research in the Capitol

Monday, March 25, 2024

11:30am - 1:30pm

Iowa State House, Rotunda

Des Moines, Iowa





# Welcome



Welcome to our eighteenth annual Research in the Capitol. In the last decade, over 1,000 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, Office of Undergraduate Research



# Schedule



**11:30am Opening Remarks**

Bob Kirby, Director, Office of Undergraduate Research

Ashley Hipnar, Student Speaker, Iowa State University

**11:45am-  
1:30pm Student Poster Presentations**

**Iowa Regents Universities  
Undergraduate Research Contacts**

**Robert Kirby, Director**

Office of Undergraduate Research

The University of Iowa

319.467.0987

bob-kirby@uiowa.edu

**Jessica Moon, Director**

University Honors Program

University of Northern Iowa

319.273.3175

jessica.moon@uni.edu

**Svitlana Zbarska, Undergraduate Research Coordinator**

Honors Department

Iowa State University

515.294.2064

szbar@iastate.edu



# Presenters



1. Albrecht, Hannah / Wols, Jenna (ISU)
2. Avdonina, Marina / Schleter, Blake (UNI)
3. Back, Hannah (UI)
4. Beeman, Kate / Gantalamohini, Amukta / McKeone, Abby / Koch, Grace (UI)
5. Behrens, Anna (UI)
6. Boodhoo, Nicole (UI)
7. Bui, Duy (ISU)
8. Clausen, Brady (ISU)
9. Cooper-Ohm, Spencer (UI)
10. Crabb, Matthew (ISU)
11. Dahlen, Grant (ISU)
12. Day, Regan (UI)
13. De Jong, Bryleigh (UNI)
14. Dickey, Ethan (UNI)
15. Entriiken, Seth / Cortes, Dani / Zumbrock, Amanda (ISU)
16. Franke, Hannah (UI)
17. Gregurek, Makenna / Blair, Thom / Ki, Yunseo / Knape, Kaitlin (UI)

18. **Hall, Makayla / Neely, Jordan (UNI)**
19. **Harrington, Ashley (UNI)**
20. **Hatch, Emily (ISU)**
21. **Heggen, Jacqueline (UNI)**
22. **Henry, Damien (ISU)**
23. **Heyer, Samantha / Neely, Jordan / Stegge, Sarah (UNI)**
24. **Hipnar, Ashley (ISU)**
25. **Homedan, Abdelrahman (UI)**
26. **Huettman, Casey (UI)**
27. **Huffman, Hannah (UNI)**
28. **Jackson, Frances (ISU)**
29. **Jauron, Drew (UI)**
30. **Kaczor, Jared (ISU)**
31. **Kehrli, Natalie (UI)**
32. **Kollasch, Serenity (UNI)**
33. **Kurtt, Alex (ISU)**
34. **Kuruppu, Adele (UNI)**
35. **Lehmkuhl, John / Mraz, Grace (UNI)**
36. **McAvoy, Cynnava (ISU)**
37. **McDowell, Anna (UNI)**
38. **McGuire, Megan (ISU)**

39. **Miller, Ashlyn (UNI)**
40. **Pate, Precious / Anderson, Morgan (UI)**
41. **Patterson, Veronica (UI)**
42. **Peach, Anna (UI)**
43. **Perrin, Alex (UNI)**
44. **Power, Josiah / Houts, Colin (UI)**
45. **Ramos, Stephanie (UNI)**
46. **Roberts-Dobie, Jefferson (ISU)**
47. **Ross, Emma (ISU)**
48. **Schmidt, Sophia (ISU)**
49. **Sharma, Divija (UI)**
50. **Taylor, Raider (UNI)**
51. **Thompson, Samantha (UI)**
52. **Tripp, Danny (UNI)**
53. **Verhoeven, Davis (ISU)**
54. **VerMulm, Ryan (ISU)**
55. **Walter, Kaitlyn (UI)**
56. **Zugay, Jonathan (ISU)**



# Abstracts



## 1. **Albrecht, Hannah / Wols, Jenna (ISU)**

Hometown(s): Le Mars / Tinley Park, IL

Major(s): Industrial Engineering / Industrial Engineering

Mentor: Leslie Potter, Devna Popejoy-Sheriff

### ***Expanding the UNIVERSE: UNderstanding Industrial Engineering VERSatility for K-12 Educators***

The Industrial Engineering (IE) profession needs people. Per the American Society for Engineering Education, 23.6% of BS degrees in engineering were awarded to women in 2021; at Iowa State University (ISU), the percentage of women studying IE was ~30-38% from 2011-2021, leaving an untapped source of future IEs. Many students don't pursue IE because they have never heard of it. With NASA funding, our first objective is designing a state-approved professional development licensure course, to be offered initially in June 2024. Thirty K-12 educators will experience IE at ISU with hands-on activities, standards-based lesson planning, and interactions with faculty and alumni. Our second objective is creating lesson(s), example(s), and messaging about IE to share with K-12 educators. With more K-12 educators who understand IE and use it in their lessons, we will increase the number of students pursuing the profession. This poster shares the course, K-12 curriculum, and lessons learned.

## 2. **Avdonina, Marina / Schleiter, Blake (UNI)**

Hometown(s): Iowa City / Dubuque

Major(s): Computer Science / Computer Science

Mentor: Dheryta Jaisinghani

### ***iBrush: An automated method to detect toothbrushing activity***

Thirty-one percent of Americans do not brush their teeth twice a day. Brushing teeth is a really important part of taking care of your health. Dentists recommend doing it twice a day for at least two minutes each time. It helps to prevent gum disease and cavities.



Currently, there are limited solutions for automated toothbrush activity detection. With the help of sensors installed in the smartwatches, we're developing machine learning algorithms that leverage the data collected from these sensors to detect brushing activity. We aim to identify tooth brushing activity accurately by differentiating it from other similar activities such as writing, typing, drinking, eating, etc. Our preliminary results indicate that we are able to detect toothbrush activity with eighty percent accuracy.

**3. Back, Hannah (UI)**

Hometown(s): Phoenix, AZ

Major(s): Data Science

Mentor: Susan Meerdink

***Remote Detection of Harmful Algal Blooms in Iowa***

Harmful algal blooms (HABs) negatively impact health, the ecosystem, and local economies. The current frequency of water quality testing (once per week) at only public beaches leaves room for human exposure. Our goal is to develop cost-effective early detection methods that can augment current testing. We evaluate the use of trail cameras and satellite imagery for detecting HABs in Big Spirit Lake, NW Iowa. A measure of water greenness from these data sources correlates with water samples. Future work will build on this initial analysis and increase our ability to track HAB development across Iowa's summers which could provide rapid feedback to the public.

**4. Beeman, Kate / Gantalamohini, Amukta / McKeone, Abby / Koch, Grace (UI)**

Hometown(s): Des Moines / Ankey / Iowa City / Des Moines

Major(s): Environmental Policy, Social Justice / Environmental Policy and Planning / Environmental Policy and Planning / Environmental Science

Mentor: Samantha Zuhlke

***Public Policy and Iowa, Drinking Water Kiosks: An Investigation of Environmental, Social, and Water Quality Concerns***

Ambiguously regulated privately-owned water kiosks present environmental, ethical, and public health issues. These kiosks sell drinking water at a higher price than tap water and claim to remove impurities, minerals, or other contaminants. However, there is no substantial evidence or way for constituents to monitor such claims. Despite Iowa's history of high-quality tap water, questionably regulated water kiosks are appearing across the state, particularly in low-income and minority communities. We seek to determine whether kiosks purify water as they claim. In Fall 2023, we collected pilot data from 10 locations in eastern Iowa to compare water quality at kiosks to adjacent publicly accessible tap locations. In Spring 2024, we are analyzing these samples to determine differences in water quality using key water quality indicators, including PFAS. We will produce a final policy report that discusses kiosk regulation, kiosks, environmental and social justice impacts, and policy solutions in Iowa.

## 5. Behrens, Anna (UI)

Hometown(s): West Des Moines

Major(s): History

Mentor: Landon Storrs

### ***Brothers and Sisters Unite: Take Back the Night in San Francisco, Cambridge, and Iowa City***

Using archival documents, this research argues that Take Back the Night marches during the late 1970s and early 1980s in San Francisco, Cambridge, and Iowa City followed similar patterns: they were motivated by local events, constructed meaning for attendees through similar structural elements, and struggled with the dilution of their messages and goals because of conflict. This research highlights communities' awareness of local statistics/frequency of attacks and knowledge of publicized trials and crimes (often serial), while arguing that the messages and goals of Take Back the Night were diluted by conflicts regarding the role of pornography, the exclusion of women of color, and the exclusion of men.

## 6. **Boodhoo, Nicole (UI)**

Hometown(s): East Moline, IL

Major(s): Biomedical Sciences

Mentor: Gordon Buchanan

### ***A novel stress mechanism in SUDEP pathophysiology: the possible role of corticosterone***

Epilepsy is a common neurological disease, affecting 65 million people worldwide. One-third of these patients are refractory to seizure medication, and the leading cause of death in this group is sudden unexpected death in epilepsy (SUDEP). Breathing dysregulation and serotonin (5-HT) impairment following a seizure are likely causes of SUDEP. Enhancing 5-HT before a seizure improved consequent breathing, but 5-HT<sub>2C</sub> agonist MK-212 dose-dependently caused fatal seizures in wildtype mice and unexpectedly caused 100% of 5-HT<sub>2C</sub> knockout mice to die following seizures. We showed 5-HT<sub>2C</sub> receptor mediates breathing following a seizure, but mortality may be due to MK-212 off-target effects, such as increasing rodent stress hormone corticosterone. Stress commonly triggers seizures, and the corticosterone pathway represents a novel mechanism in SUDEP pathophysiology. Corticosterone antagonist + MK-212 injections showed lower endogenous corticosterone, compared to only MK-212, following serum assay. Mice experience lower mortality risk when corticosterone is decreased prior to induced seizures.

## 7. **Bui, Duy (ISU)**

Hometown(s): Wauke

Major(s): Mechanical Engineering

Mentor: Ethan Secor

### ***Aerosol Jet Printing - Electronics Fabrication Technique***

Aerosol Jet Printing is an emerging additive manufacturing technique for microelectronics using various functional nanomaterial inks. For instance, instead of using electrical wires, which can take up space and weight, conductive ink, such as silver nanoparticles, can be printed directly onto the surface of interest. My project involves using an optical measurement system to conduct tests ranging from simple lines to small-scale Resistor Capacitor (RC) circuits and collect relevant data,

including cross-sectional area and resistivity, to further refine the process reliability of aerosol jet printing. To collect such data, I work with technical software and complex machine systems, including 3D Optical Profiler, Confocal Displacement Sensor, and 4-Point Probe Multimeter.

## **8. Clausen, Brady (ISU)**

Hometown(s): Okoboji

Major(s): Biology

Mentor: Leonor Leandro

### ***Impact of Soil Amendments with Digestate and Biochar on Agriculturally Significant Plant Pathogens***

Soybean diseases, including sudden death syndrome, damping off, and root rot, significantly reduce soybean productivity, making their effective management of great importance to Iowa. Our research tests soil amendments with digestate and biochar, both by-products of the biofuel industry, for suppression of three important soilborne pathogens of soybeans. Digestate is organic matter that is a by-product of anaerobic digestion for methane production. Biochar is a charcoal-like material produced by burning organic matter at high temperatures without oxygen. Our greenhouse studies showed that amendment with a 20% rate of solid digestate significantly decreased root rot severity. In addition, biochar applied to soil at 5% rate increased root and shoot dry weight, while decreasing root rot. These results suggest that both soil amendments have potential benefits for soybean disease management, in addition to the known benefits of increasing soil nutrient content, water retention, and organic matter and decreasing nitrogen run-off.

## **9. Cooper-Ohm, Spencer (UI)**

Hometown(s): Council Bluffs

Major(s): Economics, English and Creative Writing

Mentor: Jeff Desimone

### ***Analyzing the State Impacts of Good Samaritan Opioid Laws***

In response to the opioid epidemic, including a relatively recent spike in Fentanyl use, nearly every state has passed some form of Good Samaritan Opioid Law (GSL) which provides immunity

from arrest or prosecution to those who request emergency medical assistance for opioid overdoses. I use the National Center for Health Statistics, multiple cause-of-death mortality data from 1999-2021 to analyze the opioid mortality impacts of GSLs, as well as several legal provisions that vary across states. I find that GSL enactment is associated with a 7% reduction in opioid overdose deaths, and that these laws become substantially more effective the longer they are in place. Their effects are largely consistent across race, gender, and age groups. GSLs appear particularly effective in the fight against increasingly prevalent Fentanyl mortality, reducing Fentanyl-related deaths by 14%.

**10. Crabb, Matthew (ISU)**

Hometown(s): Ankeny  
Major(s): Electrical Engineering  
Mentor: Degang Chen

***Low-Cost, Accurate, Modular Digital to Analog Conversion on PCB using Built-In-Self-Test Methodology***

Digital to analog converters (DACs) are critical electronic components used when digital systems interface with the physical world. Accurate DACs are difficult to design and suffer from errors which degrade their performance. Additionally, testing is typically difficult. Much research has focused on developing built-in-self-test (BIST) algorithms for integrated DACs which allow testing to occur on-chip. This study seeks to design a modular, low-cost DAC at the printed circuit board (PCB) level, estimate its error using a BIST algorithm, and calibrate out the error to achieve high performance. Architectures are explored using simulations and tested on a PCB and a BIST algorithm will be implemented and verified. If verification is successful, the calibration process will be optimized so the DAC can be used in a direct digital synthesizer (DDS) substantially reducing the cost of this device. Accurate DDS systems are in high demand for developing Internet of Things (IoT) devices.

**11. Dahlen, Grant (ISU)**

Hometown(s): West Des Moines  
Major(s): Political Science, Criminal Justice  
Mentor: Mack Shelley

## ***The Failure to Protect the Best Interests of Iowa's Citizens Public Health and Safety by The State Government***

Iowa Senate File 69, and House File 2589. The Iowa Department of Public Health wrote a letter to the DEA asking for permission for Federal Exemption from cannabis enforcement. Iowa is the first and only state to attempt legalizing weed through this channel rather than simply ignoring Federal Law. Every single cannabis consumer in America is technically a Felon regardless of state legislation. Reexamining Federal Exemption as well as the two bills signed into legislation by our governor would make Iowa the first and only state in America to have fully legalized cannabis at all levels of the government. Over 50% of Iowans support legalization and over 70% of all Americans. The exemption would allow for federal programs to continue receiving necessary resources as well as address discrimination for current medical card holders (I.E. Section 8 Housing). In addition it could help address Iowa's brain drain dilemma as well as disenfranchisement issue.

### **12. Day, Regan (UI)**

Hometown(s): West Des Moines

Major(s): Political Science, Marketing, Business Analytics & Information Systems

Mentor: Brian Lai

### ***Impact of Artificial Intelligence on Environmental Policy Persuasion***

This research focuses on how the growing presence of AI will play a role in political communication. I distributed a Qualtrics survey to University of Iowa students, faculty, and staff over the age of 18 that included a one paragraph argument, either arguing for or against the banning of gasoline powered cars in Iowa by 2035. Within this survey, respondents received a written argument created by a human or by ChatGPT. Some respondents received a disclosure that their argument was written using ChatGPT or by a human, but others did not. The overarching goal of this study is to find a pattern based on demographic traits, how comfortable Iowans are with using AI in political campaigns, and how persuasion differs between text written by ChatGPT and by humans. This study has implications on how politicians campaign

and discuss complex policy issues with lowans in the future.

**13. De Jong, Bryleigh (UNI)**

Hometown(s): Pella

Major(s): Communication, Spanish

Mentor: Nikki Harken

***“Sit Still, Look Pretty to Survive”: An Analysis of The Hunger Games Trilogy***

At the end of a decade, a literary trilogy became a new pop culture phenomenon, The Hunger Games. The theme of appearance frequently stood out on page, however, was it truly translated on screen? Film adaptation theory explains the road to adapting a piece of literature to film is a process. All of those involved throughout the creation of cinema impact how we, as audience members, see said media. Consider the professions of the script writers, the director's ideals versus the thoughts of the author, the question of involving the original writer, creativity of the adapted world, and the audience's reactions, all affect the success of the film. Appearance was a recurring theme that shaped how the main character viewed her world and how she viewed the worlds of the antagonists, side characters, and symbols within the narrative. Survival in Panem was impossible without consideration of appearance.

**14. Dickey, Ethan (UNI)**

Hometown(s): De Witt

Major(s): Biology

Mentor: Ai Wen

***Using GIS to Evaluate Habitat Connectivity Among the Pollinator Conservation Reserve Program Restorations***

The Pollinator Habitat Enhancement Conservation Reserve Program (CP-42) allows for farmers to turn their land, once used for agriculture, into restored prairie to provide floral sources and habitat for wild pollinators. In order for these sites to be fully effective, they must be accessible to native bees and other pollinator species. Nineteen sites were surveyed between 2018 and 2019 to monitor the vegetation and the native bee communities within the area. Landscape and land-usage data

was analyzed using ArcGIS software in order to delineate and quantify potential pollinator habitat surrounding these CP-42 sites. Paired with the collected bee data, we associated the habitat connectivity among CRP sites and natural habitat to the bee diversity and density data, in order to understand the movement of these native bee species, and how these pathways are being used to establish new bee communities in these restored sites. This data can help us to examine the degree of habitat fragmentation in the landscape and the effect that it may have on the native bee communities.

**15. Entriken, Seth / Cortes, Dani / Zumbrock, Amanda (ISU)**

Hometown(s): Abel / San Jose, Costa Rica/ Wheaton, IL

Major(s): Genetics / Genetics / Genetics

Mentor: Jeffrey Essner

***Role of Gap Junction Proteins on Left-Right Development***

Directional nodal flow initiated by motile cilia in the left-right (L-R) organizer of developing embryos is required for proper establishment of L-R symmetry. Previous work in zebrafish has shown that morpholino knockouts of the gap junction (GJ) protein, Connexin 43.4 (*gjc4b*), causes disruption of the L-R organizer, Kupffer's Vesicle (KV), and correlated randomization of L-R asymmetry (Hatler et al., 2009). Interestingly, zygotic indel mutants of *gjc4b* do not disrupt L-R development of the heart, but maternal zygotic mutants do. Here, we explore the role of related connexins in the zebrafish development using a CRISPR/Cas9 mutational approach.

**16. Franke, Hannah (UI)**

Hometown(s): St. Louis, MO

Major(s): Psychology, Linguistics

Mentor: Bob McMurray

***A New Method for Investigating the Facilitative Effects of Discourse Priming on Real-Time Word Recognition***

Priming is a robust psychological phenomenon often used as a research technique, and it has been shown that words prime one



another on a conceptual level. This effect is often considered facilitatory, but eye-tracking research using the Visual World Paradigm (VWP) provides evidence for competition during this process. The current study proposes new methods to tease out the facilitatory and competitive effects of semantic priming on word recognition. In this study, participants read a passage before completing a VWP trial; the passage primed either the target, an on-screen competitor, or a non-presented word. Our preliminary findings (N=41) show a significant increase in target fixation speed after a related story ( $t(112)=-3, p<.01$ ). Further, target fixation speed was not significantly slowed when an on-screen competitor was primed ( $t(112)=.8, p=.45$ ). These results validate our priming paradigm and provide initial support for a facilitatory effect.

**17. Gregurek, Makenna / Blair, Thom / Ki, Yunseo / Knape, Kaitlin (UI)**

Hometown(s): Johnston / Naperville, IL / Iowa City / Tecumseh, MI  
Major(s): Economics, Ethics & Public Policy, Political Science / Ethics & Public Policy, Political Science / Ethics & Public Policy, Political Science / Political Science, Public Policy  
Mentor: Fred Boehmke

***Restoring the Lost Iowa Polls: Iowans' Opinion from Half a Century Ago***

The Iowa Policy and Opinion Lab, founded in 2020, has been working to enter and analyze data from some recently unearthed Iowa Polls from the 1940s through the 1980s. This year we are working with a poll from 1978. As is often the case, topics asked about decades ago are pertinent today. Such relevant issues assessed in the survey include the creation of an independent Palestinian state, the effects of high inflation, LGBTQ+ individuals and women's roles in society, approval of President Carter, and entertainment consumption. In the fall, members of IPOL double-entered data from a printout of the original data file. Now we are analyzing the results to share on our website as news stories and in a full report. Our presentation would provide an overview of work with these previously lost Iowa Polls and a description of the findings for some of the topics covered in the survey.

**18. Hall, Makayla / Neely, Jordan (UNI)**

Hometown(s): Evansdale / Tiffin

Major(s): Psychology / Psychology, Biology

Mentor: Helen C. Harton

***Examining the Credibility of Social Media Posts***

According to past research, political misinformation is prevalent within social media, where information often goes unchecked. Both liberals and conservatives tend to believe misinformation that supports their beliefs. Values emphasized also tend to differ by political orientation, with liberals being more concerned with issues of harm, fairness, and universalism, and conservatives, with loyalty, authority, purity, and self-reliance. This study examines whether misinformation susceptibility is influenced by which of these values the information appeals to. One hundred thirty-six participants read social media posts that either supported or did not support their party's platforms and that appealed to one of the seven values. They indicated whether they believed that a post was true or false and their confidence in their response, along with how likely they would be to share the information. We hypothesize that liberals and conservatives will be especially susceptible to believing misinformation that appeals to their moral values.

**19. Harrington, Ashley (UNI)**

Hometown(s): Ankeny

Major(s): Physics

Mentor: Kip Matthews

***Enhanced Head Immobilization for Gamma Knife Radiosurgery***

Gamma Knife is a radiotherapy treatment system that delivers very precise doses of radiation to brain tumors and other neurological conditions. To treat the patient, their head has to remain still and cannot move more than 1.5mm. High precision is achieved by using a patient-specific thermoplastic immobilization mask on a rigid frame. Head movements exceeding 1.5mm stop delivery so the patient can be repositioned. Experience at Mary Bird Perkins Cancer Center has shown the immobilization mask adequately limits side-to-side head motion, but head flexion isn't

as well controlled. To combat this, an add-on brace was created in CAD software and 3D printed using resin. The brace presses against the upper lip of the patient to restrict head flexion and thus allow for controlled and uninterrupted treatment. Following development, head movement will be tracked with the brace and performance of the brace will be evaluated during Gamma Knife treatments.

**20. Hatch, Emily (ISU)**

Hometown(s): Plano, TX

Major(s): Architecture

Mentor: Ulrike Passe

***Assessing the impact of increased Minimum Fresh Air per Person in classrooms in Des Moines, Iowa***

Current building energy simulation tools use preset data points that do not necessarily reflect contemporary HVAC systems and developing air circulation standards needed to combat respiratory disease in classrooms. Utilizing ClimateStudio and EnergyPlus, thermal model results calculated Site Energy Use Intensity (EUI), Operational Carbon, and Operational Energy Costs in relation to pre-existing and proposed Minimum Fresh Air per Person (L/s/p) standards. First, six public schools in Des Moines, Iowa, were investigated under current Minimum Fresh Air per Person standards. Afterward, a literature review of ASHRAE and other national and international research extrapolated new air rate recommendations. The findings suggest Operational Energy Costs are to increase an average of 5%, with the highest Minimum Fresh Air per Person recommendation, 20 L/s/p, due to Site EUI and Operational Carbon increases. It is recommended Des Moines public schools consider a higher air exchange rate to ensure adequate ventilation when combatting respiratory diseases.

**21. Heggen, Jacqueline (UNI)**

Hometown(s): Johnston

Major(s): Biology: Biomedical/ Biochemistry

Mentor: Joshua Sebree

***Entrance to Entrance: A Hunt for Astrobiological Analogs at Wind Cave***

In order to understand the pathways by which life may be sustained within the Solar System, extreme environments must be studied on Earth first. Within the Solar System, the icy moons of Europa and Enceladus contain subsurface lakes which harbor organics while calcite deposits on Mars provide evidence of ancient water. Evidence of past and present water stores a record of the terrain's history and current potential for life. Wind Cave National Park provides an opportunity to examine multiple analog environments in a single isolated setting. Currently forming flowstone stores a record of organics from the surface while zebra calcite preserves a record of ancient water once existing in the cave. Using a portable spectrometer, the unique color fingerprint of cave formations can be analyzed. By studying analogs in the cave which resemble our Solar System, the minimal conditions that life can be established in extreme environments can be examined.

**22. Henry, Damien (ISU)**

Hometown(s): Blockton

Major(s): Electrical Engineering

Mentor: James McCalley

***Planning Iowa's Energy - What do the People Want?***

The Iowa Economic Development Authority has approached Dr. McCalley to do a study on the visions, needs, and future of Iowa's Energy Infrastructure (which Dr. McCalley has coined Planning Iowa Energy – or PIE). As part of this project, Dr. McCalley would like to gauge the temperature (support or lack thereof) of Iowa residents on the visions and goals set forth by the PIE project and other renewable initiatives. Our research team is conducting interviews, surveys, and ultimately analysis on these topics to help guide this project.

**23. Heyer, Samantha / Neely, Jordan / Stegge, Sarah (UNI)**

Hometown(s): Charles City / Tiffin / Le Mars

Major(s): Biology, Gerontology: Social Sciences / Psychology, Biology / Communication Disorders, Gerontology: Social Sciences

Mentor: Elaine Eshbaugh

## ***Education, Empathy & Empowerment: Reflection on the World of Dementia***

At the Dementia Simulation House, we offer the opportunity for participants to experience what life may be like for someone living with dementia in a home setting. About 80% of individuals living with dementia live at home in the community, and we aim to show participants what it might be like for these individuals to complete chores and activities of daily living. During the simulation, we put gear on an individual to simulate dementia. Then participants go through a debriefing which involves writing a reaction word. We sorted the reaction words and calculated percentages on the popularity/common phrases or words to examine the reactions of participants at the Dementia Simulation House. Common reaction words included anxious, difficult, humbling, trapped, and inadequate. These reactions give us insight into how participants respond to their experience and how it differs from their expectations.

### **24. Hipnar, Ashley (ISU)**

Hometown(s): Council Bluffs

Major(s): Environmental Science and Global Resource Systems

Mentor: Monica Haddad

### ***How City Governments are Addressing Climate Justice Globally: A Systematic Literature Review***

Climate justice should be a global guiding pillar in city adaptation and mitigation efforts, as climate change disproportionately affects vulnerable social groups. This systematic literature review (SLR) asks, What are city governments doing to plan for climate change and achieve justice, ensuring that vulnerable social groups are included in such strategies? The methodology included article identification, screening, eligibility, and inclusion criteria, ending with 110 articles, all analyzed by four guiding themes: justice in action, community engagement, partnership formation, and financial mechanisms. Results show that although city governments often discuss climate justice, implementation of justice needs to be addressed when planning for climate change. The presence of community engagement, partnership formation, and financial mechanisms were robust tools often used in cities with success in justice planning. This SLR also provides three

lessons learned from the literature and how governments can implement effective climate justice.

**25. Homedan, Abdelrahman (UI)**

Hometown(s): West Des Moines

Major(s): Neuroscience

Mentor: Cathleen Moore

***Perceptual Organization in Peripheral Vision***

Perceptual organization is a type of cognitive processing that allows us to abstract information about a scene that is not physically present in the stimulus itself. Examples of perceptual organization include surface completion, abstraction of 3D surface structure from 2D image geometry, and surface scission from transparency. This type of processing is known to occur in central vision, where stimuli are near fixation. Visual processes, however, are less reliable for stimuli that are farther away from fixation, (i.e., in the peripheral visual field). We therefore hypothesized that, unlike central vision, perceptual organization does not occur in peripheral vision. We used a known measure of perceptual organization, the Configural Superiority Effect (CSE), to measure three different perceptual organization processes at two different eccentricities, one near fixation and one in the periphery. Consistent with our hypothesis, we observed significant CSEs for stimuli presented centrally, but not for stimuli presented peripherally.

**26. Huettman, Casey (UI)**

Hometown(s): Peosta

Major(s): Chemistry & International Studies

Mentor: Johna Leddy

***Sustainable Ion-Exchange Membranes for use in Ethanol Fuel Cells***

Ethanol fuel cells are a promising approach to low-cost clean energy in Iowa. This research aims to design a sustainable energy generation device using ethanol as a fuel. Three main challenges become apparent in this process: effective catalysts, polymer components, and power output. This work focuses on the polymer component, more colloquially known as the separator or

ion-exchange membrane. Commercially available membranes are fully fluorinated, which poses significant environmental challenges and economic barriers. This work demonstrates a method of producing alternative membranes that enable effective ionic charge transfer, protect from solvent crossover, and prevent contact between electrodes, all of which are critical to cell functionality. The alternative membranes are entirely sustainable and financially scalable, with proven success in enhancing ethanol fuel cell capabilities.

**27. Huffman, Hannah (UNI)**

Hometown(s): Waterloo

Major(s): Anthropology

Mentor: Donald Gaff

***Unearthing UNI's First Football Stadium***

Campus archaeology conducted at the University of Northern Iowa unearths historical artifacts that are tied to the institution's past. In 2020, students in the archaeological fieldwork class performed excavations at the former Latham Stadium site, where remnants of the structure were discovered, documented, and archived for further examination. My research of the artifacts includes collaborative efforts between university archives, close laboratory analysis, and the interpretation of hand-written journals from fieldwork students who recorded their data on-site. This interdisciplinary approach provides a comprehensive understanding of the site's historical significance and glimpses of human occupation that span decades into the past.

**28. Jackson, Frances (ISU)**

Hometown(s): Garwin

Major(s): Agricultural Business & Accounting

Mentor: Alejandro Plastina

***The Financial impact of using Cover Crops on Integrated Farming Operations***

My research focuses on the financial impact of using cover crops on farms with and without livestock. Data from one of Practical Farmers of Iowa's surveys was used. This data provided information from Nebraska and Iowa farmers who had fields that

both did and didn't use cover crops. My analysis highlights the difference in revenues and expenses related to grazing cover crops and biomass that remains in fields after harvest. To add further dimension to the data, I examined the difference farmers' experience in cover crop usage has on their grazing budgets. I also compared the livestock farmer's cover crop revenue and expense streams to farms without livestock production that use cover crops.

**29. Jauron, Drew (UI)**

Hometown(s): Grimes

Major(s): Management

Mentor: Kenneth Brown

***Student Use of AI Generative Text to Prepare for Asynchronous Video Interviews***

With ChatGPT's introduction in 2022, AI generative text has shown potential to change how individuals complete work and learning tasks. Prior research suggests, though, that less than a fifth of U.S. adults have used ChatGPT, and that as few as half of U.S. undergraduates have adopted AI generative writing for their coursework. Asynchronous Video Interviews (AVI) are another new technology influencing hiring procedures for many companies, where participants record and submit video answers to later be viewed by recruiters. The purpose of this study is to determine how undergraduate business students use AI generative text when given encouragement to do so, how participant's attitudes towards AI change, and how beneficial AI generative text can be as a preparation tool for an AVI assignment. Qualitative and quantitative data was collected from an undergraduate professional preparation class, and results from this study inform our understanding of students' use of AI tools.

**30. Kaczor, Jared (ISU)**

Hometown(s): Garner

Major(s): Chemical Engineering

Mentor: Eric Cochran

***Selectively Implosive Chemical Recycling of Poly(Ethylene Terephthalate)***



Polyethylene terephthalate is a semicrystalline polyester with excellent thermomechanical properties. It consists of terephthalic acid (TPA) units joined together with ethylene glycol spacers. This forms a formidable crystalline domain that is resistant to most chemicals. The PET chain, thus, must be suitably redesigned to facilitate facile chemical recycling. Introduction of reactive units nicknamed Trojan Horse (T.H.) units such as nitroterephthalic esters (EWG-electron withdrawing-TPA) can undergo significantly faster hydrolysis to initiate scission along the PET backbone. The dosage of these trojan horse units is varied from 2.5%-10% to strike an optimum balance between chemical and mechanical properties along with ease of recyclability. The redecorated PET chain bespeckled with nitro-TPA units undergo faster hydrolysis to their building blocks at milder conditions compared to virgin PET; thus alleviating the energy considerations of the chemical recycling process, ultimately evoking commercial interest.

### **31. Kehri, Natalie (UI)**

Hometown(s): Manchester

Major(s): Psychology

Mentor: Amanda McCleery

#### ***Physical Activity in College Students with Schizotypal Characteristics: Group Differences and Associations with GPS-Derived Mobility Indices***

Schizophrenia is a complex mental illness characterized by positive and negative symptoms, in addition to cognitive deficits that impact an individual's mental/physical health and daily functioning. Many individuals with schizophrenia also present with health comorbidities that render this population susceptible to poor physical health. These factors contribute to a reduction in the average life expectancy by 15-20 years in schizophrenia. Therefore, identifying interventions to support physical health is crucial. The current research indicates that individuals with schizophrenia spectrum disorders engage in less physical activity than non-psychiatric comparators, and physical activity shows associations with symptoms in this group. However, there is limited research examining physical activity in those with elevated schizotypal characteristics, individuals who may be at higher risk of developing schizophrenia. This project focuses on understanding the relationship between self-reported physical

activity and geolocation derived mobility indices in undergraduates with and without elevated schizotypal characteristics.

**32. Kollasch, Serenity (UNI)**

Hometown(s): Cedar Falls

Major(s): Political Science

Mentor: Ana Kogl

***I Failed My Brother: How Online Radicalization Affects the Family Unit***

This research aims to understand the impacts of online radicalization on the family unit, with a specific focus on the immediate emotional toll on household members of individuals who have been radicalized through online platforms. My goals include understanding family members' emotions, exploring their personal experiences, distinguishing radicalization from exposure, and analyzing online radicalization from the family's perspective. I hope to answer the following: What are the mental and emotional effects of online radicalization on the immediate family members of individuals who have been exposed to or subscribe to radical and extremist beliefs online? This data will hopefully contribute to a broader understanding of the impacts of radicalization while also offering insights to develop techniques for mitigation of any negative consequences of online radicalization, as well as tackling the issue of online extremist behavior more broadly.

**33. Kurtt, Alex (ISU)**

Hometown(s): West Des Moines

Major(s): Biology and Environmental Science

Mentor: Amy Toth

***Influences of non-flight thermogenesis variation in *Bombus impatiens****

As temperature patterns continue to change globally, understanding how bee populations will react is vital when implementing conservation initiatives. Bees have the ability to regulate internal temperatures, similarly to mammals, using their wing muscles to generate core heat that is essential for pollination. While the mechanisms of this "non-flight

thermogenesis” has been studied in detail, the factors that affect individual variation remain relatively unlooked. This study focuses on how caste (queens, workers, and drones), mass, and seasonality affect the rates of rewarming in a common lowa bumble bee species. Measuring core temperature during rewarming from a chill coma can serve as a non-lethal estimate of thermal physiology and demonstrate how extreme temperatures may affect activity levels of various pollinators.

### **34. Kuruppu, Adele (UNI)**

Hometown(s): Centerville

Major(s): Management: Business Administration

Mentor: Russell Guay

#### ***Small Business Burnout: Reversing the Entrepreneurial Burnout***

This thesis aims to review the current literature on entrepreneurial burnout, identify critical issues, conduct qualitative interviews with current small business owners, evaluate and assess the research findings, and produce a plan for both new and experienced entrepreneurs to avoid and minimize burnout. As a business and entrepreneurship student interested in opening a small business myself, I have become drawn to the topic of burnout and how it affects the family dynamic. My hope for this thesis is to identify fundamental causes, symptoms, effects, and solutions for burnout in small business owners and entrepreneurs. Entrepreneurs can use this research to avoid burnout in themselves and others to run their businesses to the best of their ability while maintaining a healthy work-life balance.

### **35. Lehmkuhl, John / Mraz, Grace (UNI)**

Hometown(s): Ames / Waverly

Major(s): Biology: Biomedical/ Biochemistry / Biology, Public Health

Mentor: Jim Demastes

#### ***Sequence and Characterization of the Fragmented Mitochondrial Genome of the Chewing Louse, Geomydoecus centralis***

The DNA of living organisms is packaged into chromosomes

differently in different species, but typically following a standard set of "rules." Understanding how DNA can be packaged for different species provides a better understanding of life and the genetic rules that must be followed, and the "rules" that can be broken. Mitochondria are crucial subcomponents of cells, providing the energy for life. Mitochondria always have their own mtDNA. In our study, we have learned that chewing lice mtDNA differs from that of other animals by spreading the genes across 12 separate small, circular chromosomes instead of one large, circular chromosome. We sequenced and mapped these minicircles to better understand the organization and rearrangement of genes through evolutionary time. Recognition of developmental rearrangements within the mtDNA allows for greater understanding of potential conditions that may lead to mitochondrial dysfunction. This knowledge may benefit the development of treatments for devastating mitochondrial diseases.

### **36. McAvoy, Cynnavia (ISU)**

Hometown(s): Cumming

Major(s): Biological Systems Engineering

Mentor: Sara McMillan

#### ***Tracing Phosphorus Pathways in Walnut Creek: A Study in Iowa's Agricultural Watershed***

Our research focuses on phosphorus dynamics in Walnut Creek, Iowa, a region dominated by agriculture. We are studying phosphorus movement and deposition due to its potential for deleterious environmental impact, particularly eutrophication in downstream waters. In November 2023, we collected sediment samples from six sites along the creek, each representing different geomorphic features. These samples are being analyzed for various parameters, including pH, organic matter, particle size, total phosphorus, and KCl extractable phosphorus. We are also assessing phosphorus sorption via equilibrium phosphorus concentration (EPC) to determine whether the sediment absorbs or releases phosphorus. Results are pending as sample processing continues through the spring. The findings will be compared with other environmental factors to better understand the drivers of phosphorus retention and release. This study highlights the need to understand phosphorus dynamics in

streams to develop strategies for reducing phosphorus export, with potential implications for streams across agricultural landscapes.

**37. McDowell, Anna (UNI)**

Hometown(s): Burlington

Major(s): History, The Study of Religion

Mentor: Cara Burnidge

***Redefining 21st Century Evangelicalism***

Though evangelicalism is a buzzword in modern America and is typically associated with politics, the evangelical movement began in eighteenth-century America. In the 21st century, evangelicalism proves difficult to define. Though some thinkers define evangelicalism using theological distinctives, the movement has become bound with politics in the minds of many Americans. As a result, evangelicalism typically has negative connotations. Even though many people define evangelicalism in its American context, evangelicalism has spanned the globe and impacts people from diverse backgrounds. The purpose of this project is to explore how evangelicalism has been defined and the impacts of American and global evangelicalism in the late twentieth and early twenty-first centuries.

**38. McGuire, Megan (ISU)**

Hometown(s): Ankeny

Major(s): Criminal Justice and Psychology

Mentor: Stacy Renfro

***Producing Datasets: Capturing Images on Multi-Camera Smartphones for Source Camera Identification***

The lack of data available in the forensic science community proves to be an ongoing problem. The project's objective was to create a publicly available dataset containing many images from all available cameras on recent models of smartphones. The digital evidence team at the Center for Statistics and Applications in Forensic evidence (CSAFE) worked with sixty recent models of multi-camera smartphones including ten Samsung Galaxy Note 10s, ten Samsung Galaxy s20s, ten Samsung Galaxy s21s, ten iPhone 11 Pros, ten iPhone 12 Pros, and ten iPhone 14 Pros.

Each of these sixty smartphones contains four individual cameras: the front selfie camera, the rear telephoto camera; the rear wide-angle camera; and the rear ultra-wide-angle camera. For each camera on each phone, the CSAFE team captured one hundred natural scene images and one hundred flatfield images. This dataset will soon be available and will be used to develop source camera identification methods.

**39. Miller, Ashlyn (UNI)**

Hometown(s): Burlington

Major(s): Family Services

Mentor: Nathan Taylor

***Gender Socialization and Social Media in College Students' Fear of Crime***

The purpose of this study is to explore the relationship between gender, viewing crime related material on social media, and fear of crime experienced by college students. While violent crime rates have fallen, the majority of college students report levels of crime are increasing. Many individuals lack both knowledge and experience related to crime, leading media exposure to influence their levels of fear. Previous research has focused on television media related to fear of crime with little research on social media, the preferred media source of young adults. College students (n = 126) from a midwestern university completed a survey assessing fear of crime, social media and crime knowledge, and personal safety behaviors. Findings from this research have important implications on theory and policy, adding to an understanding of what predicts and influences fear of crime and how to align fear of crime with actual victimization risks.

**40. Pate, Precious / Anderson, Morgan (UI)**

Hometown(s): Iowa City / Davenport

Major(s): Public Health / Biology

Mentor: Maurine Neiman

***Analyzing Endopolyploidy in freshwater snails***

Variation in the number of nuclear genome copies, or polyploidy, is a topic at the frontier of research in biology. Endopolyploidy, the existence of higher ploidy cells within organisms that are

otherwise of a lower ploidy level (reviewed in Neiman et. al. 2017), has been implicated in the expression of genes, tissue regeneration, cancer, and complex anti-predator defense phenotypes. While endopolyploidy is common across all eukaryotes, its prevalence and function remains unclear, especially in animals. We use the invasive New Zealand freshwater snail *Potamopyrgus antipodarum* (Potamos) to provide new insights into animal endopolyploidy. Potamos are especially well suited for this purpose because they have varying organismal ploidy levels, from diploid (2 genome copies) to triploid and tetraploid (3 and 4 genome copies, respectively). Triploid and tetraploid Potamos are asexual, allowing an important control against genetic variation generated by meiosis in sexual reproduction. In the project, we used flow cytometry to create ploidy maps of Potamos of varying ploidy levels to help illuminate the phenomenon of endopolyploidy in an important group of animals.

#### **41. Patterson, Veronica (UI)**

Hometown(s): Iowa City

Major(s): Mathematics and Dance

Mentor: Hao Fang

##### ***Mathematicians Extending Help to Ballerinas: How to Best Turn?***

This research project delves into the kinematics of a specific ballet movement called a pirouette- a challenging turning motion performed on one leg. The study's main goal is to decipher certain underlying biomechanics of a pirouette, providing valuable insights to dancers and instructors alike. Through an investigation of the vertical force produced by the dancer at the beginning of a pirouette, adjustable variables influencing the production of vertical force will be identified. The key adjustable variables of a pirouette, including the distance between the feet in the preparatory position, the length of pli  (bending of the knees motion) before a pirouette, and the number of completed rotations in a pirouette, were selected as having a hypothesized influence on vertical force. An experiment involving ten dancers measured their vertical

forces using force plates while adjusting these variables.

**42. Peach, Anna (UI)**

Hometown(s): Story City

Major(s): Global Health Studies

Mentor: Blake Rupe

***College Food Security: Practices and Perspectives of Students at the University of Iowa and Kirkwood Community College***

Food security is a nationwide issue that has been shown to disproportionately affect college students. Campus resources, including food pantries and financial support systems, are often used to address this, yet there is little research on the access to off-campus resources and shopping locations utilized by students. This study aims to understand the practices and perspectives of undergraduate students related to food security and barriers to obtaining food in the Iowa City-Cedar Rapids area. A sequential mixed methods approach was used at the University of Iowa and Kirkwood Community College with an initial survey to understand undergraduate knowledge of resources and food security. A subsequent round of interviews investigated the practices of students in acquiring food and related stressors. Results indicate that while food security is a unique experience for all, similarities exist in the barriers to food access, and gaps in aid for college students in this region.

**43. Perrin, Alex (UNI)**

Hometown(s): Thurman

Major(s): Social Science Teaching

Mentor: Donna Hoffman

***Senatorial Behavior in Recent Supreme Court Confirmation Hearings***

Supreme Court confirmation hearings in the Senate have heightened stakes in today's political environment. The public stands at attention while Senators engage in questions and dialogue with the nominees. With increased stakes after the 2016 removal of the filibuster, Senators are in a prominent position to



demonstrate their opposition to a nominee during the hearing. This study shows how Senators have quantitatively changed their tactics since 2016. I show this by examining the transcripts of the six most recent hearings (Roberts, Alito, Sotomayor, Kagan, Gorsuch, and Kavanaugh). I was able to show that opposition Senators engage in significantly more back-and-forth with the nominees now, and that Democrats in the Gorsuch and Kavanaugh hearings increased the number of questions they ask to nominees as a reaction to the ignoring of Merrick Garland's nomination in 2016. This study offers a unique and novel perspective on a complicated political process.

#### **44. Power, Josiah / Houts, Colin (UI)**

Hometown(s): Iowa City / Sioux City

Major(s): Chemical Engineering

Mentor: Eric Nuxoll

##### ***Thermal Susceptibility of Polymicrobial Biofilms***

Biofilms on medical devices cause hundreds of thousands of infections and cost the healthcare industry billions of dollars each year. Most infected implants must be surgically removed and replaced in a painful and expensive process. Heating the implant in situ is an alternative to surgical implant removal that has been shown to reduce bacterial biofilm populations. Most thermal susceptibility studies to date have investigated single-species biofilms. The effect of a second bacterial species on the thermal susceptibility of the first was unknown. To address this, biofilms of *Staphylococcus aureus* and *Pseudomonas aeruginosa* were grown both individually and together on microscope slides. The biofilms were thermally shocked to determine the effect of heat on bacterial density. Results confirm that heat shocks substantially decrease biofilm populations and indicate that *P. aeruginosa* substantially weakens the thermal shock resistance of *S. aureus*, while *S. aureus* does not impact the thermal susceptibility of *P. aeruginosa*.

#### **45. Ramos, Stephanie (UNI)**

Hometown(s): Des Moines

Major(s): Social Work/Music: General Studies in Music

Mentor: Tyler Hendrickson

## ***Preventing Injuries in Violinists and Violists Through Body Awareness and Appropriate Set-Up***

There is a frequency of injuries among violin and viola players caused by the lack of physical support from the use of ill-fitting instrumental set-ups. Instrumental set-ups include chinrests and shoulder rests, which are not “one size fits all” contraptions. One such risk from ill-fitting set-ups are muscle strains due to using excessive force when holding the instrument. The purpose of this presentation is to help violin and viola players identify their specific body shape and diagnose signs of discomfort caused by an ill-fitting set-up. This presentation will assist them in finding supportive instrumental set-ups through the use of different chinrests and shoulder rests of varying heights, widths and shapes and match them to their individual body shape to alleviate discomfort and prevent injuries that can create adverse impacts on their life as a musician, including reduced mobility, incorrect posture, head and neck displacement, and physical inability to continue performing.

### **46. Roberts-Dobie, Jefferson (ISU)**

Hometown(s): Cedar Falls

Major(s): Chemical Engineering

Mentor: Eric Cochran

### ***Soybean-based polymers for reclaimed asphalt roads***

Using a combination of a soy-based surfactant, a substance that helps water and oil mix, and another soy-based polymer, asphalt millings can be converted into a much stronger road than just the millings alone. The polymer helps to improve the asphalt’s mechanical properties as well as bind the asphalt millings together, creating a stronger road. The surfactant converts a very viscous, thick, polymer into something that can be spray applied and decreases the particle size of the other biopolymer, increasing the ability of that polymer to penetrate the asphalt. The soybean-based surfactant is created by modifying soybean oil and then reacting it with a bio-based hydrophilic monomer. The use of the surfactant increases the viability of the RAP roads, keeping asphalt out of the landfills; saving money and resources in the long run.

**47. Ross, Emma (ISU)**

Hometown(s): Estherville

Major(s): Chemistry

Mentor: Kirill Kovnir

***A benchtop route from elemental Se to superior thermoelectric  $\beta$ -Ag<sub>2</sub>Se***

$\beta$ -Ag<sub>2</sub>Se is a remarkable material for thermoelectric applications, but enhancing its performance through doping techniques has remained a challenge. Over the past years, research has been devoted to interstitial, vacancy, and substitutional doping into the parent  $\beta$ -Ag<sub>2</sub>Se structure, aiming at tuning the material's charge and heat transport properties to enhance thermoelectric performance. The transformation of  $\beta$ -Ag<sub>2</sub>Se into  $\alpha$ -Ag<sub>2</sub>Se at  $\sim 134^\circ\text{C}$  and the low solubility of dopants are the main obstacles for doping approach. In this research, we will display our progress in creating a safe, straightforward, and an inexpensive synthesis procedure to obtain pure and metal-doped  $\beta$ -Ag<sub>2</sub>Se at near room temperature. Our research will also address our progress in enhancing the electrical and thermal transport properties of  $\beta$ -Ag<sub>2</sub>Se upon metal-doping – resulting in an increase in  $zT$  from  $\sim 0.65$  (pristine) to  $\sim 1.30$  (metal-doped  $\beta$ -Ag<sub>2</sub>Se) at  $120^\circ\text{C}$ . Additionally we will compare the results of different metal dopants and trends we discover. In conclusion, this new proposed synthesis procedure offers a new route to create  $\beta$ -Ag<sub>2</sub>Se of the highest caliber with negligible energy input while investing in superior energy sources.

**48. Schmidt, Sophia (ISU)**

Hometown(s): St. Anthony, MN

Major(s): Horticulture

Mentor: Suzanne Slack

***Panic in the Orchards! Characterizing Streptomycin Resistance in Iowa Erwinia amylovora Isolates***

Fire blight is considered one of the worst apple and pear diseases worldwide since it can kill trees and wipe out whole orchards in as little as one season. Caused by the bacterium *Erwinia amylovora*, fire blight has been historically controlled by using the antibiotic streptomycin during flower bloom. However, recently in Iowa

growers noted that there were more fire blight outbreaks even with applications of streptomycin. Our group at Iowa State discovered that these orchards had strains of *E. amylovora* that were resistant to streptomycin. Further study using DNA sequencing techniques determined that the resistance came from a random mutation from strains that originate from Iowa. Preliminary findings also show that the mutation causing complete streptomycin resistance is present in at least 30 Iowa strains. Ultimately, identifying the strains and understanding the resistance mechanisms of these isolates will give growers direction for possible treatment options to save their orchards.

**49. Sharma, Divija (UI)**

Hometown(s): Iowa City

Major(s): Psychology

Mentor: Paul Windschitl

***First Information is the Last Information***

Decision makers often establish an early preference after being exposed to preliminary information about their choices, and this early preference can affect how subsequent information about choice options is processed. Importantly, such information distortion can have a substantial influence on people's final judgments and decisions. In this study, we aim to test the role of information distortion when making predictions about future outcomes. In this study, participants are presented with basic information about two job applicants and asked to make predictions about who got the job at an architecture firm. Even though the resume designs are equivalent in quality, we predict that participants would have a leading alternative that would influence their later evaluations and predictions about other components of the applications such as cover letters and ultimately who got the job. This demonstrates how information distortion extends to a level beyond personal preferences, i.e., to factual analysis as well.

**50. Taylor, Raider (UNI)**

Hometown(s): Center Point

Major(s): Mathematics Teaching

Mentor: Kimberly Conner

***Connecting the Dots: Analysis of Teachers' Questions during Dot and Number Talks***

Dot Talks and Number Talks are a 5-15 minute math activity in which students build their number sense by solving math problems mentally, while the teacher facilitates by asking questions. During dot and number talks, teachers should be using deep, insightful questions to help students think about mathematical ideas and relationships. In this study, we trace the types of questions 13 teachers asked across their first dot talk and two number talks with 3rd - 8th grade students. We categorized every single question the teacher asked a student, and analyzed them. We found there was not a significant difference between the types of questions teachers asked during dot talks compared to number talks. A majority of the questions that were asked across these 39 videos were surface level questions that did not necessarily provoke students to provide justifications, discuss mathematical connections, or respond to a peer's thinking. Although, it was found that throughout the three videos, students had more opportunities to respond to their peers' thinking. Findings suggest that teachers need professional support to learn how to ask questions that are specific to student thinking and provide meaningful opportunities for student response.

**51. Thompson, Samantha (UI)**

Hometown(s): Davenport

Major(s): Biochemistry and Molecular Biology

Mentor: Christopher Ahern

***Synthesis of the Aryl Sulfonamide Ion Channel Blocker PF-C39***

The sodium ion channel NaV1.5 is the primary cardiac voltage-gated sodium channel (VGSC), and it initiates the electrical signals that control the beating heart. Though NaV1.5 predominates, other VGSCs such as NaV1.3 may be involved in

cardiac remodeling after injury. Unfortunately, the overwhelming NaV1.5 current makes it difficult to study other channels. We have developed a mouse model with a NaV1.5 channel that can be selectively inactivated, allowing other sodium channels to be studied. This project focuses on the synthesis of PF-C39, an aryl sulfonamide drug with a high selectivity and affinity for NaV1.3. After inducing a heart failure model in cardiomyocytes, we will suppress the NaV1.5 current and apply PF-C39 to pharmacologically detect NaV1.3, which may become active in failing heart tissue. Administration of the drug will provide insight into how the electrical systems in the heart change when under duress, and this work may identify potential therapeutic strategies.

## **52. Tripp, Danny (UNI)**

Hometown(s): Cedar Falls

Major(s): Social Work

Mentor: Jaimie O'Gara

### ***The Impact of COVID-19 Related Stress on Parenting and Community Engagement in a Small Iowa Community***

This study addresses the question, “Does COVID-19-related stress and household income during COVID-19 predict parents’ interactions with children and family community engagement one year later?” The hypothesis was that higher levels of COVID-19-related stress and lower household income would predict more negative interactions between parent and the focal child and less community engagement. The participants within this study were drawn from a larger ongoing study, the Dubuque Youth and Family Resilience Project (DYFRP). Control variables included household income, child’s gender, and child’s age. The independent variable was reported COVID-19 related stress and the dependent variables were community engagement, positive parenting styles, and negative parenting styles from Wave 2. Descriptive statistics and bivariate correlations of all control and study variables were conducted. While the results did not reach significance, their directionality concurred with the beginning hypothesis concerning COVID-19 related stress and parenting interactions.

### **53. Verhoeven, Davis (ISU)**

Hometown(s): Ames

Major(s): Biology

Mentor: David Verhoeven

#### ***Engineering an Improved mRNA Vaccine***

mRNA vaccines were pivotal in the fight against COVID-19. mRNA technology enables faster vaccine development and may lead to improved immunity. However, high production costs due to inefficient manufacturing processes and expensive components prohibit global vaccinations. These costs also prevent the use of current mRNA vaccines in production animals. We designed a new mRNA-based vaccine that is far more economical. Where Pfizer's COVID-19 vaccine costs \$19 to manufacture, ours costs approximately \$0.58. These lower costs expand vaccine accessibility, supporting vaccination in developing nations and underserved communities. Expanded vaccination may help prevent new viral variants and empowers everyone to safeguard their health. Our lower costs also allow our vaccine platform to be used in production animals, expanding the benefits of mRNA vaccines to the veterinary field. While research is ongoing, our vaccine shows promise at providing a safe, affordable, and effective bulwark in the battle against disease.

### **54. VerMulm, Ryan (ISU)**

Hometown(s): Hartley

Major(s): Architecture

Mentor: Eric Badding

#### ***The Evolution of Architectural Skin - Adaptive & Reactive Architectural Facade***

The adaptive & reactive facade aims to revolutionize architectural design by harnessing modern technologies to create an environmentally responsive building skin. Traditionally, buildings act as barriers between interior and exterior environments and rely heavily on energy-intensive mechanical systems, which currently are responsible for consuming 18% of global emissions. The project envisions a transformative global impact by exploring designs that significantly reduce thermal conditioning demands. Inspired by the intricate evolution of animal skins in harsh

environments, which aims to extract knowledge for an adaptable facade system. Through the analysis of pre-existing adaptive facade systems and other diverse contributors I will discover the intersection between design and reality. Ultimately, I will manufacture and test a model challenging conventional facades commonly used in the industry. Leveraging technology to diminish dependence on mechanical systems aligns with the project's goal of breathing life into architectural design, and potentially alleviating the severity of global energy consumption.

**55. Walter, Kaitlyn (UI)**

Hometown(s): Bettendorf

Major(s): History, Ancient Civilization

Mentor: Viridiana Hernandez

***The Rise of the Chocolate Chip Cookie: Kitchens, Cookbooks, and Modernity in the Early Twentieth Century***

This thesis explores the chocolate chip cookie's sudden popularity in the 1930s. It argues this popularity was rooted in challenges created by the oven's technological innovations and in the publication of new cookbooks addressing those difficulties. In the nineteenth century, ovens relied upon a present cook to monitor the oven's heat and the bake's progress using a vague recipe. However, in the twentieth century, ovens had thermostats and timers, allowing for exact recipes. Home cooks struggled updating older recipes, and they needed to learn new baking methods. Motherly figures like Ruth Wakefield published cookbooks to aid toiling bakers. The cookie's popularity offers a unique look at how American cooks grappled with modernity's rapid onset in the 1920s and 1930s by turning to motherly figures offering traditional baking concepts while embracing new methods and ingredients. This thesis evidences cookbooks and newspapers to demonstrate these changes and the pressures home cooks faced.



**56. Zugay, Jonathan (ISU)**

Hometown(s): Slater

Major(s): Political Science

Mentor: David Peterson

***Iowa Caucus Polling Project***

The Iowa Caucuses are the quintessential political event. Knowing what Iowans think about the candidates serves a vital role in understanding how the campaign played out. Researchers at Iowa State University partnered with the polling firm Civiqs to explore the “whys” of the Iowa Caucuses. Every month from September to January, respondents answered twenty research questions asking their opinions about politics. These questions would include general queries such as opinions about the candidates to more complex concepts such as opinions on aid packages to Ukraine, abortion, or their approval of the Speaker of the House. The data collected were analyzed and visualized to present trends and ideas that can be extrapolated from the data. This presentation will emphasize how the ongoing divide among congressional Republicans related to the differences in how Iowa Republican voters thought about the major candidates for the Republican nomination.



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