Iowa Regent Universities present the

19th Annual Research in the Capitol

Monday, March 31st, 2025
11:30am - 1:30pm

Iowa State House, Rotunda

Des Moines, Iowa

❧ Welcome ❧

Welcome to the **nineteenth annual** Research in the Capitol. Since its inception, over 1,100 undergraduates from the 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 then gone on to contribute to our state as doctors, educators, engineers, lawyers, nurses, and professionals within a wide variety of disciplines. This opportunity for our students to share their knowledge and enthusiasm with legislators, Regents, and guests in the Iowa Capitol is truly an honor that has stayed with them through the years.

Research involvement plays a key role in undergraduate education. Students who participate in research are more successful in their studies, more developed in career and professional preparation, and feel 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 their careers. 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 scholars, you will have a chance to learn firsthand the impact that these involvements have had on Iowa's students, and the impact those students then have on the research being conducted at our outstanding Iowa Public Universities.

Tawny LB Tibbits

Director, Office of Undergraduate Research

❧ Schedule ❧

11:30am Opening Remarks

Tawny Tibbits, Director
University of Iowa Office of Undergraduate Research

Hiruni Sumanasiri, Student Speaker
University of Iowa

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

Iowa Regents Universities
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Presenters

1. Allison, Bethany (Iowa State University)
2. Alstott, Emma (Iowa State University)
3. Anderson, Anna (University of Northern Iowa)
27. Anderson, Julia (University of Iowa)
32. Apana-Stipe, Ella (University of Iowa)
4. Bez, Krishangee (Iowa State University)
5. Bez, Kristi (Iowa State University)
6. Blum, Sydney (University of Northern Iowa)
7. Boardman, Reed (University of Iowa)
8. Brennom, Emily (University of Northern Iowa)
9. Carlo, Emily (University of Northern Iowa)
10. Collier, Morgan (University of Iowa)
26. Correia, Julia (University of Iowa)
11. Cunningham, Connor (University of Northern Iowa)
12. Danenhauer, Addison (Iowa State University)
13. Davis, Paige (Iowa State University)
27. DeMarco, Vanessa (University of Iowa)
14. Deters, Adam (University of Iowa)
1. Dwamena, Mike (Iowa State University)
15. Grieser, Jadin (University of Northern Iowa)
16. Hageman, Aden (University of Iowa)
17. Harms, Haley (University of Northern Iowa)
18. Harper, Zachary (University of Northern Iowa)

19.   Heggen, Jacqueline (University of Northern Iowa)

20.   Hennessy, Meabh (Iowa State University)

21.   Henrichsen, Ella (Iowa State University)

22.   Hersom, Samuel (Iowa State University)

23.   Hidalgo-Murra, Jolien (Iowa State University)

24.   Hutchins, Abby (University of Northern Iowa)

25.   Jacobo, Kamilla (University of Iowa)

26.   Joiner, Tara (University of Iowa)

27.   Junkins, Connor (University of Iowa)

28.   Kehrli, Natalie (University of Iowa)

53.   Khadiya, Malvika (University of Iowa)

29.   Klopfenstein, Caden (Iowa State University)

30.   Krier, Kaci (University of Northern Iowa)

31.   Ladenburger, Maria (Iowa State University)

32.   Li, Ondrea (University of Iowa)

33.   Liu, Yiming (University of Iowa)

34.   Logue, Lauren (University of Northern Iowa)

35.   Martinez, Ava (University of Iowa)

35.   Martin-Trainor, Jami (University of Iowa)

36.   McCoy, Riley (University of Iowa)

35.   McPike, Landon (University of Iowa)

37.   Montalvo, Lizbeth (University of Northern Iowa)

38.   Moore, Cameron (University of Iowa)

39. Motes, Asher (University of Iowa)

40. Petersen, Sara (University of Northern Iowa)

41. Pintor-Mendoza, Daniela (University of Iowa)

41. Ramirez, Brenda (University of Iowa)

42. Robinson, Samantha (University of Northern Iowa)

53. Sachtschale, Austin (University of Iowa)

43. Santos Correa, Laura Mariana (Iowa State University)

44. Sharma, Niall (Iowa State University)

45. Shettigar, Bhoomika (University of Iowa)

46. Smith, Chloe (Iowa State University)

47. Smith, Kai (University of Northern Iowa)

48. Stevens, Ashley (Iowa State University)

49. Sumanasiri, Hiruni (University of Iowa)

50. Taylor, Charles (Iowa State University)

10. Thiel, Nora (University of Iowa)

51. Tounjian, Casandra (University of Northern Iowa)

52. Tounjian, Catrina (University of Northern Iowa)

53. Valentin, James (University of Iowa)

54. Van Meter, Olivia (University of Northern Iowa)

55. Verma, Anurag (Iowa State University)

56. Widmer, Claire (University of Northern Iowa)

57. Williamsen, Hannah (University of Iowa)

58. Wood, Grace (Iowa State University)

59. Young, Isaac (University of Iowa)

✦ Abstracts ✦

1. Bethany Allison (ISU) / Mike Dwamena (ISU)

Hometown: Overland Park, KS / Germantown, WI
Major(s): Scientific Illustration & Visualization / Scientific
Illustration & Visualization
Mentor(s): Kim Moss

The First Farmers: Communicating the Complex Societies of Leafcutter Ants Through Scientific Illustration in a Mural

Atta cephalotes, commonly known as leafcutter ants, are among nature's most remarkable farmers, cultivating fungi in a highly complex mutualistic relationship. As part of an internship in scientific visualization at Iowa State University, we developed a series of educational murals to enhance the Insect Zoo's first permanent exhibit, located in the Advanced Teaching and Research Building. Our goal was to communicate the behaviors, morphology, and ecological significance of leafcutter ants in an engaging yet scientifically accurate way.

In creating these murals, we conducted extensive research using academic literature, live and preserved specimens, and photo references of their natural habitats. With these resources, we were able to determine aspects of the species that were not readily illustrated. Examining preserved specimens provided detailed insights into their morphology, ensuring anatomical accuracy in our illustrations.

Using the platforms Adobe Photoshop and Adobe Illustrator, we designed and rendered large-scale digital illustrations. The mural series consists of a sequential illustration depicting the queen's development of a new *Atta cephalotes* colony and doorway panels highlighting the complex caste system of the ants. Key educational elements include labeled scientific names, morphological differences between castes and the mutualistic relationship between the fungi and ants.

This project bridges science and art through scientific communication, fostering curiosity and appreciation for entomology in our community. By blending accurate illustrations with compelling design, our murals invite ISU students, faculty, and visitors to explore the hidden world of *Atta cephalotes* ants, the first farmers of the natural world.

2.   Emma Alstott (ISU)

Hometown: Fort Dodge, IA
Major(s): Horticulture and Global Resource Systems
Mentor(s): Suzanne Slack

Susceptibility of European and Asian Pear Cultivars to Fire Blight Disease in the Midwest

Pear production in the Midwest is greatly limited by fire blight, a devastating bacterial disease affecting apples and pears that results in tree death. Caused by *Erwinia amylovora*, fire blight can be severe on traditional cultivars of European pear (*Pyrus communis*). However, new European and Asian pear (*Pyrus pyrifolia*) cultivars have been introduced, claiming improved resistance to fire blight. While initial resistance screenings of these new cultivars have been conducted elsewhere, a comprehensive screening using *E. amylovora* strains unique to the Midwest remains lacking. To address this, in 2023 and 2024, 16 cultivars of European and Asian pears were screened for disease incidence. In addition to traditional shoot inoculations, flowers and fruits were tested with multiple *E. amylovora* strains to assess infection rates. We included six genetically diverse strains, Ea110, CA11, Ea88, Ea1189, IA01, and FC01, all originating from different regions. Notably, IA01 and FC01 were isolated in Iowa. Results showed that all pear cultivars were susceptible to strains Ea110 and IA01, while most were resistant to Ea88, a strain from Washington. Further analysis of pears infected by Ea110 and IA01 showed that resistance was generally higher among European cultivars but varied widely among Asian cultivars. As a result, several European pears, such as "Moonglow" and "Harrow Delight," and Asian pears, such as "20th Century" and "Chojuro," exhibited moderate to low susceptibility to fire blight across flowers, shoots, and fruits. Overall, our findings offer critical insights for pear growers in Iowa and the Midwest, where fire blight poses a persistent threat. By identifying cultivars with improved resistance and evaluating regional pathogen diversity, this research helps growers make informed decisions on variety selection and disease management. These insights increase the options for pear production in Iowa while reducing the economic impact of fire blight by minimizing reliance on chemical control strategies.

3. Anna Anderson (UNI)
Hometown: Waterloo, IA
Major(s): Social Science Teaching/Spanish
Mentor(s): Elise DuBord

The Schooling Experiences of Heritage Speakers in Iowa: In Their Own Words

The experiences of heritage speakers (i.e. people who grew up speaking Spanish) in Spanish classrooms in Iowa vary greatly. Heritage speakers have different academic needs, prior knowledge, and cultural backgrounds than those who are learning Spanish as a second language. Previous research discusses the academic benefits or disadvantages of mixing heritage speakers into classes with second language learners, however less research exists that discusses the feelings, thoughts, and perspectives of the heritage speakers themselves, especially in the Midwestern context. Through interviews with seven heritage speakers who studied Spanish in both high school and college, it came to light that many participants felt their Spanish did not improve in their high school classes and reported uncomfortable experiences with both teachers and peers. The findings of this project suggest that the educational system in Iowa often leaves heritage speakers to fall in the cracks, both academically and socially.

4. Krishangee Bez (ISU)
Hometown: Shillong,India
Major(s): Chemistry
Mentor(s): Emily Smith

Study on the Effect of Imidazolium Ionic Liquids on Delignification of Biomass from Feedstock

The gradual increase in the world's energy consumption is causing tremendous strain on non-renewable resources. There is a need to increase the Nation's energy resources and energy security. Therefore, the search for alternative fuels has drawn immense attention from the scientific community in recent decades. Lignocellulosic biomass, derived from feedstocks, is one of the potential energy sources for biofuels like bioethanol and biodiesel. However, biomass pretreatment is still performed with corrosive acidic or basic solutions to remove the lignin component in biomass that hinders the production of biofuels.

In recent years, ionic liquid has been proven to be an efficient medium for biomass pretreatment to segregate lignin from cellulose. Ionic liquids are nonhazardous, environmentally benign, recyclable, and have better operational temperature window than organic solvents. However, few studies explain the efficacy of ionic liquids in biomass pre-treatment. Therefore, using a Raman microscope, we plan to study the effectiveness of ionic liquids from other solvents. To identify the signatures of chemical constituents in the Raman spectrum, we cleaned readily available feedstock, such as corn stover, pampas grass, and citrus grass with water, ethanol, and hexane. We treated the feedstock with ammonia for 36 to 72 hours at 55 °C, followed by enzymatic hydrolysis with cellulase for 48 hours at around 40 °C. Cellobiose was used as a control for comparing the kinetics of the hydrolysis process. The methodology will be extended to the pretreatment of biomass with imidazolium ionic liquids with varied alkyl chains, such as 1-methylimidazolium chloride, 1-butyl-3-methylimidazolium chloride, and 1-methyl-3-octylimidazolium chloride, and study the effect of alkyl chain on delignification by estimating glucose from enzymatic hydrolysis in each case. This presentation will discuss our initial observations on untreated and ionic liquid-treated biomass and the kinetics of enzymatic hydrolysis.

5.   Kristi Bez (ISU)
Hometown: Meghalaya, India
Major(s): Mechanical Engineering
Mentor(s): Jonathan Claussen

Field-Deployable Sensor System for Mapping Pesticide Spray and Drift

The global population is projected to grow to approximately 9.7 billion by 2050, necessitating a significant increase in worldwide food production—estimated at 60–110%—to meet the demands of this growing population. Over 1 billion pounds of pesticides are applied to US crops annually as they are critical to meet current and future food demands. The vast

Majority of pesticides are classified either as herbicides, insecticides, or fungicides, making pesticides the second most environmentally applied chemicals, behind only fertilizers. There is a need to monitor pesticide spray for proper spray distribution depending on the pesticide being sprayed. The development of highly sensitive, field-applicable, cost-effective sensors and sensor systems is key for monitoring pesticide spray during application and detecting pesticide drift post-application. We have

created a sensor that utilizes an interdigitated electrode (IDE) design and laser-induced graphene (LIG) as the base material. This sensor measures the resistance across the IDE legs when droplets of an analyte are deposited on the surface. This allows us to calibrate the sensors for pesticide solutions based on their specific conductivities. We have also developed a custom sensing system using ESP32 microcontrollers due to their built-in ability for wireless communication. This innovative approach enables real-time monitoring of resistance readings throughout the entire spraying process.

6. Sydney Blum (UNI)
Hometown: Nebraska City, NE
Major(s): Anthropology
Mentor(s): Tyler O'Brien

Who owns their dead: Unequal access to repatriation in the United States

Museums and scientific institutions in the United States house human remains and important cultural objects in their collections; materials obtained in various manners over the past few centuries. In 1990, Congress passed the Native American Graves Protection and Repatriation Act, which mandated that federally funded institutions return Native remains and cultural objects to the affiliated tribe. Over the last three decades the rules have been modified a couple of times with the input of tribes and institutions. This has become an ongoing negotiation process as both public and professional conversations change. In recent conversations of repatriation, the topic has even expanded outside of Native claims and into African American claims. Understanding these conversations is critical to understanding the evolving process of repatriation. This paper's purpose is to analyze the conversations from the past and today concerning federally unrecognized tribes' access to repatriation and the emerging discussion surrounding African American access to repatriation.

7.   Reed Boardman (UI)
Hometown: Harlan, IA
Major(s): Psychology
Mentor(s): Bruce Bartholow

From Voltage to Motor Output: Using Mixed-Effects Modeling to Investigate the Role of Neural Event-Related Signals in Error Monitoring and Cognitive Control

The human neural-cognitive system's ability to execute goal-directed motor actions is essential for survival. To function efficiently, this limited-capacity system must dynamically adjust cognitive effort based on prior performance and experience. This study examines how neural error-related activity predicts post-error behavior, offering insight into the temporal and spatial dynamics of error monitoring and cognitive control at both within- and between-subject levels. Along with other analyses, mixed-effects models were applied to predict post-error behavior while accounting for subject- and trial-level variability in electroencephalographic (EEG) data. To our knowledge, this is the first application of this specific analytic approach for this combination of data. Results support prior work highlighting the role of early fronto-central activity in error monitoring, but challenge assumptions about later parieto-medial activity, which failed to predict trial-level post-error behavior. These findings raise new questions about the distinct contributions of these neural signals to cognitive control processes.

8.   Emily Brennom (UNI)
Hometown: Marion, IA
Major(s): Social Science Teaching/Pre-Prof: Law
Mentor(s): Jayme Renfro

The Legacy of Redlining: Examining Educational Inequalities in Cedar Rapids, Iowa

This study investigates the lasting impact of redlining on educational inequality in Cedar Rapids, Iowa. Redlining, a discriminatory housing practice, segregated communities and restricted resources based on race and socioeconomic status. The research explores disparities in school funding, student demographics, and academic achievement between formerly redlined and non-redlined areas. Using a combination of literature review, historical data, and spatial analysis, the study seeks to uncover

patterns linking redlining to modern educational outcomes. Hypotheses include lower funding, higher minority populations, and lower achievement levels in redlined areas. Data collection and analysis will identify how historical redlining practices influence current structural inequalities. The expected findings aim to emphasize the importance of implementing specific policy changes, such as more equitable funding distribution and efforts to reduce segregation. By linking historical housing discrimination to current educational challenges, this research strives to guide strategies for building a more equitable and inclusive education system in Cedar Rapids and beyond.

9. Emily Carlo (UNI)
Hometown: Pella, IA
Major(s): Anthropology
Mentor(s): Tyler O'Brien

A New Application of the Coimbra Method for Cranial Entheseal Changes

The study of entheseal changes (EC) has a lengthy history within biological anthropology, aiding in the reconstruction of habitual activities, lifestyles, and physiological stress experienced by past populations. However, most existing research has focused on postcranial entheses, leaving cranial entheses largely unexplored. This study aims to apply the Coimbra Method, a recent and standardized scoring system, to analyze cranial entheses and investigate the relationship between age, sex, and entheseal changes. By observing and scoring entheses associated with the insertions of five cranial muscles, this research will contribute to a deeper understanding of skeletal plasticity in response to mechanical stress. The findings are expected to provide new insights into cranial musculoskeletal adaptations and expand the applicability of the Coimbra Method beyond postcranial sites. Ultimately, this research has the potential to enhance anthropological reconstructions of behavior and biomechanics, offering a more comprehensive approach to the study of EC in the human skeleton.

10. Morgan Collier / Nora Thiel (UI)
Hometown: Manchester, IA / Chanhassen, MN
Major(s): Speech & Hearing Sciences / Speech & Hearing Sciences
Mentor(s): Elizabeth Walker

Individual Differences in Word Learning: Factors Supporting Growth Trajectories in Vocabulary Breadth and Depth for Adolescents with Hearing Loss

Children who are deaf or hard of hearing (D/HH) show vocabulary delays relative to typical-hearing peers, which can lead to cascading negative effects in reading achievement. Prior research in children who are D/HH has focused primarily on vocabulary breadth (how many words one knows), and not depth (how much one knows about a word). Research is also lacking on vocabulary development into adolescence. The current presentation examines the trajectories of vocabulary breadth and depth in children who are D/HH and age-matched children with typical hearing, as well as the factors that influence the variation. Results demonstrate that children who are D/HH have deficits compared to age-matched hearing peers in both vocabulary breadth and depth at school entry, but this gap closes by junior high. One factor that helps close this gap in children who are D/HH is having greater auditory access via hearing aids.

11. Connor Cunningham (UNI)
Hometown: Okoboji, IA
Major(s): Mathematics/Physics
Mentor(s): Andrew Stollenwerk

Tuning the magnetic properties of CrI3 using Ni thin film deposition

Our research focuses on potential materials for quantum computing, seeking to develop different materials to create stable quantum states at room temperature. Specifically, we research chromium triiodide (CrI3) and how its magnetic and electrical properties change when a thin layer (less than 20 atoms tall) of nickel (Ni) is placed on its surface. We deposit the Ni onto CrI3 under ultra-high vacuum and analyze it using Raman spectroscopy. Raman spectroscopy uses a laser to interact with the sample, inducing vibrations in the Ni-coated CrI3 crystal. Analyzing the reflected light from the laser gives insight into these vibrations, allowing us to deduce the electronic and magnetic properties of the sample. We found that adding Ni causes the normally oppositely magnetically aligned surface layers of CrI3 to become aligned with each other, suggesting potential use to establish a quantum state. Future work is necessary to determine the stability of this state.

12. Addison Danenhauer (ISU)
Hometown: Urbandale, IA
Major(s): Microbiology
Mentor(s): Sudhir Kumar

Investigating Molecular Mechanisms in Plasmodium falciparum Gametogenesis and Transmission

Plasmodium falciparum is the causative agent of malaria, a disease that kills hundreds of thousands especially children under the ages of five every year. This project's goal is to understand the possible molecular mechanisms of *Plasmodium* gametocytogenesis that can be useful for future anti-malarial interventions. We are generating gene deletion parasites using CRISPR/Cas-9 mediated transgenesis to investigate the function of genes involved in this process.

13. Paige Davis (ISU)
Hometown: Des Moines, IA
Major(s): Biochemistry
Mentor(s): Vincenzo Venditti

Investigating AlkBH2 Conformational Dynamics Using NMR Spectroscopy:A Potential Target in Cancer Treatment

ALKBH2 is a crucial enzyme involved in maintaining epigenetic stability within human DNA. Its overexpression has been linked to increased incidence of glioblastoma, bladder, lung, and other cancers, and it may play a significant role in cancer treatment resistance. Given Iowa's notably high cancer rates, understanding the structure and function of cancer-related proteins like ALKBH2 is particularly relevant. This study utilizes nuclear magnetic resonance (NMR) spectroscopy to investigate the conformational dynamics of ALKBH2, providing insights into its structural behavior and potential as a therapeutic target. By characterizing its molecular motions, we aim to contribute to the development of more effective, targeted cancer treatments and prevention.

14. Adam Deters (UI)
Hometown: Clinton, IA
Major(s): Human Physiology
Mentor(s): Shujie Yang

Developing Novel Endometrial Cancer Drug Treatments using Patient Derived Xenograft Models In-Vivo and In-Vitro

Over the last 40 years, endometrial cancer (EC) is the only cancer type with declining survival rates, highlighting the urgent need for improved treatment. The heterogeneous nature of EC contributes to varied outcomes with current treatments. Our project aims to establish reliable endometrial cancer models for characterizing each individual tumor, distinguishing optimal drug treatments, and determining specific drug effect mechanisms for personalized therapy. At present, our lab has collected 83 endometrial tumor samples and successfully established 43 patient-derived xenograft models (PDX) and 12 patient-derived primary cancer cell lines (PDC). Using these models, we have screened 179 FDA-approved anticancer drugs and identified many potential novel chemotherapies. This current study presents a promising direction for developing personalized therapy options for EC patients and provides a platform for further investigation of drug mechanisms and tumor development. This information will aid in prevention, diagnosis, and prognosis of endometrial cancer.

15. Jadin Grieser (UNI)
Hometown: Lone Tree, IA
Major(s): Political Science/Public Administration
Mentor(s): Jayme Renfro

Yearbooks as a tool in racial history research

There are a variety of aspects of a town that assist in showing how it has been racially exclusionary. This research project focuses on one main way, and that is through the attitudes and racial makeup of Cedar Falls High School from 1917-1990. By looking at different activities pictured within the yearbook, when the first Black student enrolled in CFHS, when the first Black teacher was hired, and other aspects that would show racial integration or discrimination, further insight is given into why Cedar Falls would be considered a sundown town.

16. Aden Hageman (UI)
Hometown: Iowa City, IA
Major(s): Physics, Japanese
Mentor(s): Ravitej Uppu

Semiconductor Quantum Dots Made from Gallium Antimonide

Semiconductor quantum dots (QDs) are a class of highly tunable crystalline nanostructure which strongly confine electrons inside them. Because of this confinement, these so-called 'artificial atoms' exhibit bright, uniform single photon emission and high optical coherence, two properties essential for building advanced quantum networks. Traditional QDs made with gallium arsenide (GaAs) emit at ~900nm, a range too inefficient for effective use within fiber-optics. Our group focuses on novel QDs made from gallium antimonide (GaSb) which emit at ~1500nm, allowing for easy integration into existing telecommunication schemes. Using various spectroscopy techniques, we have comprehensively characterized GaSb QDs fabricated with different growth parameters, optimizing their optical properties. We have observed high single photon purity and coherent emission in the telecom band, demonstrating the potential of these QDs as a platform for future quantum technology.

17. Haley Harms (UNI)
Hometown: Arnolds Park, IA
Major(s): Physics/Pre-Prof: Law/Political Science
Mentor(s): Andrew Stollenwerk

Effect of surface preparation on spin glass behavior at the Ni/MoS2 interface

Our research examines the magnetic behavior of nickel (Ni) deposited on molybdenum disulfide (MoS_2), a material with potential applications in quantum computers. Incorporating MoS_2 into these technologies requires a thorough understanding of how it interacts with ferromagnetic metals. Using Scanning Tunneling Microscopy and Transmission Electron Microscopy methods, we found that heating MoS_2 before depositing Ni creates a more structured interface compared to unheated samples. This difference affects the material's magnetic properties, suggesting that magnetic disorder arises from both the interface structure and the Ni film itself. Understanding these effects is essential for improving materials used in data storage, energy-efficient electronics, and other advanced technologies.

18. Zachary Harper (UNI)

Hometown: Decorah, IA
Major(s): Earth Science
Mentor(s): Mohammad Z. Iqbal

Subterranean Flow Dynamics in Coldwater Cave

Northeastern Iowa is home to Iowa's longest cave system Coldwater Cave. Nestled under the rolling hills and farms of the karst driftless region the ground gives way to seventeen and half miles of river passage decorated with large carbonate flowstone formations of stalagmites and stalactites. By calculating the saturation index (LSI) of the waters as it moves through the drainage basin, we can get a better understanding of if these delicate formations are still actively growing or slowly dissolving away. Furthermore, by calculating the current water quality index (WQI) of the surface stream above the cave, Coldwater Creek, we analyze the ions making their way into the freshwaters both on the surface and deep within the cave.

19. Jacqueline Heggen (UNI)

Hometown: Johnston, IA
Major(s): Biology: Biomedical/ Biochemistry
Mentor(s): Joshua Sebree

Beneath the Surface: 3D LiDAR Mapping Coldwater Cave

Before instrumentation can be used for exploration of other planets, techniques must first be tested in model environments on Earth. Terrestrial caves offer a unique opportunity to explore extreme environments that are isolated in nature but remain just within human reach. Near Cresco Iowa, Coldwater Cave is a river cave containing numerous flowstone features and large breakdown areas. Using LiDAR (light detection and ranging), features within the cave can be precisely measured using lasers to make a highly accurate 3D model. These models will be used to evaluate the durability and sensitivity of the LiDAR sensor in river terrains as well as educate future cavers on the cavern itself. By testing sensitive technology in hostile environments, applications of extraterrestrial application can be explored.

20. Meabh Hennessy (ISU)
Hometown: Ames, IA
Major(s): Undecided

Impact of Genotype on the Accuracy of an Image-Based Maize Leaf Angle Phenotyping Algorithm

While AngleNet, an automated phenotyping tool, provides effective leaf angle measurements at scale, discrepancies exist between AngleNet measurements and historically collected manual measurements across maize genotypes. This project aims to evaluate reliability of AngleNet by identifying genotypic traits associated with discrepancies. This provides information for improving AngleNet's accuracy and flexibility across genotypes for scalable phenotyping and support advancements in maize breeding.

This project utilizes a database of maize plant images, along with a dataset of images and corresponding AngleNet measurements. These were used to evaluate the accuracy of AngleNet's leaf angle outputs and identify features contributing to measurement accuracy. First, AngleNet's outputs were examined to identify patterns in inaccuracies. Based on these observations, a classification system was developed using a combination of identified leaf points—stem, collar, and midrib—to categorize errors. Then, the data was used to analyze and statistically compare differences across genotypes. To assess the significance of observed trends, t-tests were conducted to evaluate measurement inaccuracies between different genotypes and correlation tests were performed to determine relationships between specific genotypic traits and AngleNet accuracy.

Among the classifications, midrib misidentification exhibited the highest measurement error rate and accuracy varied between genotypes. Findings suggest that differences in AngleNet accuracy among genotypes stem from system biases, such as the composition of training data. AngleNet was shown to have better accuracy for genotypes similar to those it was initially trained on. These insights would suggest the need to supplement the AngleNet training process with hard to predict maize genotypes.

21. Ella Henrichsen (ISU)
Hometown: Rochester, MN
Major(s): Kinesiology
Mentor(s): Ann Smiley

Examining the Cognitive Style of Field Independence in Pre-Dental Students

Our aim was to explore field independence (a cognitive style characterized by reliance on internal cues and enhanced spatial visualization) in pre-dental students at Iowa State University. Two tests were administered: the Embedded Figures Test (EFT), which evaluates the ability to identify simple shapes within complex patterns, and the Mirror Tracing Test (MTT), which requires tracing a shape while looking into a mirror that reverses the image. It was hypothesized that pre-dental students would outperform non-pre-dental students on these two tests. The ability to identify shapes within a complex pattern is one of the tests on the Dental Admission Test (DAT), which is like the EFT. The clinical skill of using a mirror to guide dental tools is important for becoming a successful clinician. Given the importance of indirect vision in dental practice, the MTT was chosen as the second skill assessment. Students from the pre-dental club were recruited for the experimental group (n=16, 8 females) and other students were recruited for the control group (n=16, 8 females). All participants completed both tests in one testing session. Time-to-complete and accuracy for each test were recorded. To analyze the results, a nonparametric Mann-Whitney U test was used to compare EFT accuracy (out of 20 total) between groups, while an independent samples t-test was applied for the other variables. Results showed that pre-dental students made fewer errors on the MTT compared to non-pre-dental peers ($p < 0.005$), and they also were more accurate on the EFT ($p < 0.001$). There were no significant differences in time-to-complete either test. Our hypothesis was partially supported: pre-dental students outperformed non-pre-dental students in accuracy on both the EFT and MTT but did not complete the tasks significantly faster. Findings from this study could inform dental school admissions by identifying cognitive traits that predict success in dentistry.

22. Samuel Hersom (ISU)
Hometown: Highland, IL
Major(s): Aerospace Engineering
Mentor(s): Simone Servadio

Guidance in the 4-Body Problem

Low-energy Earth-Moon transfers are desirable due to their low cost and extended launch windows. The Planar Bicircular Restricted Four-Body-Problem (PBRFBP) can give a sense of real-world dynamics for simulations. There are many families of solutions with tradeoffs in delta V and transfer time for ballistic capture orbits. Earth-Moon transfers can be optimized using single and multiple shooting methods. Numerical solving methods can be used to find families of solutions. Two-impulse and many-impulse Earth-Moon PBRFBPs can be quickly solved and optimized using MATLAB tools. The solver can find optimal initial conditions (ICs), giving optimal starting location and transfer time to reach the moon with an Initial circular Earth orbit at a height of 167 km and a final circular Lunar orbit of 100 km. These tools were used to find optimal orbits to reach the moon. The results were compared with published solutions to test the model with multiple shooting methods.

23. Jolien Hidalgo-Murra (ISU)
Hometown: Fort Worth, TX
Major(s): Elementary Education
Mentor(s): Namrata Vaswani

CyMath Program and the Effectiveness of Early Arithmetic Intervention

This research aims to find the effectiveness of various tutoring practices for elementary students in the subject of mathematics. The long-term goal of the CyMath program is to increase the percentage of students from underrepresented groups who are academically ready to pursue and thrive in STEM Majors in their college-level education. Fluency in elementary and secondary mathematics is a foundational skill for academic and professional success in STEM Majors and builds upon itself. Using graduate and undergraduate students in Engineering as tutors and providing them with training on math teaching pedagogy and best teaching

practices has already led to positive results with multiple of the twenty 3rd-4th graders in the program. Though standardized testing is not the only way to track a student's knowledge, students who have been in the program for a year have shown an increase in their scores. Most recently, we have introduced robotics and other means of technology into sessions, which has increased positive attitudes towards mathematics.

24. Abby Hutchins (UNI)
Hometown: Johnston, IA
Major(s): Biology-Honors Research/Pre-Prof: Physical Therapy
Mentor(s): Carl Thurman

A High Resolution Photographic Guide for Identifying Fiddler Crabs from the Shores of the Atlantic Ocean

The aim of this project is to make high-resolution images of the 23 species of fiddler crabs inhabiting coastal regions of Europe, East Africa, North America, Gulf of Mexico, Caribbean, and South America. So that these can be used by anyone to identify species, the images will be published on the UNI - Rod Library ScholarWorks webpage (https://scholarworks.uni.edu/) and publicly available on the World Wide Web.

25. Kamilla Jacobo (UI)
Hometown: Clinton, IA
Major(s): Psychology
Mentor(s): Nichole Nidey

Compassionate Communication: Preferred Language for Adults with a History of Pregnancy and Substance Use

Language plays a critical role in shaping healthcare experiences, particularly for individuals with a history of substance use during pregnancy. The words and phrases used by healthcare providers can significantly impact patients' perceptions of self-worth, trust in their provider, and overall treatment outcomes. Stigmatizing terms, such as "drug addict" or "substance abuser," have been shown to perpetuate negative stereotypes, causing patients to feel judged, disrespected, or less likely to engage openly in their care. Compassionate and inclusive terms, like "person with a history of substance use" or "individual in recovery," empower patients, foster trust, and encourage honesty during treatment. Research from the EMPOWER Project, co-designed with individuals with

lived experience, reveals that respectful language not only enhances patient-provider relationships but also supports recovery by acknowledging the person's strengths and progress. Adopting patient-preferred terminology is essential for reducing stigma, improving healthcare outcomes, and promoting equitable, person-centered care for this vulnerable population.

26. Tara Joiner / Julia Correia (UI)
Hometown: Orange City, IA / Iowa City, IA
Major(s): 3d Design / 3d Design, Music
Mentor(s): Monica Correia

Seamless 3-Dimensional Woven Forms with Sustainable Materials

The global home textile market is worth $124.72 billion and is expected to grow 6.0% in the next three years. Along with these impressive numbers comes a equally shocking environmental impact. The textile industry produces an estimate of 92 million tons of waste globally every year. Our research aims to limit the amount of waste by fabricating a seamless 3-dimensional loom to create curvy forms. The cutting process in fabric production, the seam, generates 10-15% of the global waste. This means that 10-15% of the materials are discarded. The loom that is being fabricated in our research helps envision a new form of 3-dimensional textile while simultaneously striving to eliminate material waste. To further develop this research, we traveled to Mertola, Portugal over the summer to learn 200+ year old traditional weaving techniques with 3D elements. Our research will minimize the production of textile waste.

27. Connor Junkins / Julia Anderson / Vanessa DeMarco (UI)
Hometown: Iowa City, IA / McCamey, TX / West Des Moines , IA
Major(s): Political Science / Political Science, Religious Studies / Ethics and Public Policy, Political Science, Economics
Mentor(s): Nicholas Martini

Combating Racial Disparity in Iowa Prisons: A Three Prong Approach

Iowa prisons struggle with racial disparity. The issue is multi-faceted and cannot be tackled from any one single angle. Rather, the systems that underlie the disparity must be dismantled at every stage in the criminal legal system. Through our research, we have found that there are several

ways to dismantle racial disparity throughout the system. In the end, our recommendation is reform for three different areas: public defense, jury selection, and administrative practices. Within the scope of public defense reform, we suggest creating an oversight commission for state offices. In matters of jury selection, providing stricter scrutiny to peremptory strikes would help to make juries a better representation of the community. Finally, in administrative reform, issuing guidelines for prosecutorial discretion. While these options don't solve the issue at large, they plug crucial holes in racial prison disparity.

28. Natalie Kehrli (UI)
Hometown: Manchester, IA
Major(s): Psychology
Mentor(s): Amanda McCleery

Measuring Physical Activity in the Schizophrenia-Spectrum: Insights From Pedometry-Based Studies

Individuals with schizophrenia (SCZ) engage in lower levels of physical activity (PA) than non-psychiatric comparators, contributing to poor health outcomes. Self-report methods for assessing PA may be subject to recall bias, highlighting the need for additional measurement tools. Pedometry, including smartphone-based step tracking, offers a potential solution. This poster reviews literature on the feasibility, accuracy, and psychometric properties of pedometry in individuals with SCZ. Findings indicate that while smartphone pedometers are a low-burden alternative to self-report measures, their accuracy varies, particularly at lower walking speeds. Despite these limitations, pedometry has been shown to reliably track PA and correlate with mental and physical health outcomes. Future research should examine the reliability and validity of smartphone-based pedometry in SCZ populations, ensuring its effectiveness as a tool for monitoring PA and informing interventions aimed at improving health outcomes in individuals at increased risk for psychotic disorders.

29. Caden Klopfenstein (ISU)
Hometown: Maple Grove, MN
Major(s): Bioinformatics
Mentor(s): Claus Kadelka

Unveiling Biases in PREM Contact Matrices: A Critical Examination and Pathways to Improvement

The PREM framework, widely used for projecting social contact matrices globally, relies on 2005 POLYMOD data, which may no longer accurately reflect contemporary social mixing patterns. This study aims to critically assess the biases inherent in these matrices when applied to 2019 populations, focusing on outdated data and missreporting trends. Preliminary analysis suggests that these biases can lead to inaccurate epidemic projections, affecting the estimated basic reproduction number (R0) and the efficacy of targeted interventions. While the full extent of these biases remains to be quantified, our research highlights the need for updated contact matrices that reflect modern demographic shifts and behavioral changes.

In addition to identifying these biases, we propose potential solutions to enhance the accuracy of contact matrices. These include integrating dynamic demographic data, incorporating socioeconomic factors, and ensuring reciprocity in contact patterns. By addressing these methodological limitations, we aim to improve the reliability of epidemic models and public health interventions. This study contributes to ongoing efforts to refine contact matrix construction and application, ultimately enhancing the effectiveness of disease modeling and policy design.

30. Kaci Krier (UNI)
Hometown: Green Mountain, IA
Major(s): History
Mentor(s): Robert Dise

Outlaws, Lawmen, and the Emergence of Justice on the Western Frontier

My thesis covers the beginning of law and law enforcement in the Wild West, with a focus on the Arizona and New Mexico Territories between 1840-1890. I utilized historical records to understand a greater political landscape in these territories, to answer the question if the "Wild West"

was as wild as it was remembered. From my findings, the "Wild West" might not be as wild as originally thought, due to the common historical representations not fully being supported by the numbers. Because numbers don't fully support the title, it is important that scholars look deeper into the research before deeming the "Wild West" as a dangerous time period.

31. Maria Ladenburger (ISU)
Hometown: West Des Moines, IA
Major(s): Environmental Science, Animal Ecology
Mentor(s): Amber Crowley-Gall

Examining the effect of microbial ecology on Bombus impatiens feeding behaviors

The relationship between yeast and insects has been heavily studied; however, the role that microbial ecology plays in these interactions is less understood. The Metschnikowia clade of yeasts provides a useful system to explore these questions as its species are widely distributed throughout a variety of ecological niches and display varying degrees of specialization. This study examines the effect of Metschnikowia species with varying ecologies on the feeding preferences of Bombus impatiens (common eastern bumble bee).The results of this study will be the first step in assessing if yeast ecology influences pollinator foraging decisions and will build a foundation for future work examining the impacts of microbial ecology on insect-microbe interactions.

32. Ondrea Li / Ella Apana-Stipe (UI)
Hometown: Des Moines, IA / Norwalk, IA
Major(s): International Relations and Journalism /
Political Science, Ethics and Public Policy
Mentor(s): Nicholas Martini

Addressing Rural Iowa's Physician Shortage and Healthcare Challenges

Rural Iowa faces significant health challenges due to a shortage of physicians. This research report assesses the leading causes and effects of this shortage on healthcare quality and recommends both long-term and short-term policy solutions. We focus on Iowa and physician-specific issues, proposing two main policy avenues: Increasing/Expanding Retention and Recruitment Programs and implementing direct institutional assistance like Telehealth.

33. Yiming Liu (UI)

Hometown: Coralville, IA
Major(s): Biology
Mentor(s): Georgina Aldridge

Exploring synapse loss and protein co-pathology in neurodegenerative disease

Neurodegenerative dementias affect nearly 55 million people worldwide. Despite their prevalence and high societal and economic burden, there are no available disease-modifying treatments for neurodegenerative disease. Neurodegeneration is characterized by cognitive decline and the loss of neurons, neuron structure and their function. Diagnosis is based on the presence of protein aggregates containing molecules called amyloid, tau, alpha-synuclein and TDP-43. Recent studies have shown that these proteins often co-occur, with combinations of protein pathologies being the norm rather than exception. Although these pathologies are used in disease staging and diagnosis, synapse loss is the best statistical correlate of cognitive decline. The site of the most common type of chemical synapse is the dendritic spine. Spines are structurally dynamic neuronal protrusions that are important for brain connectivity and function. We visualize dendritic spines, neuronal complexity, and protein co-pathologies to explore the hitherto unknown impact of co-pathology on synapse loss.

34. Lauren Logue (UNI)

Hometown: Adel, IA
Major(s): Psychology/Spanish
Mentor(s): Helen Harton

Hireability of Female Hispanic Applicants by Accent/Career Type and Participant First Language

This study will add to the literature by testing the perceptions of Hispanic accents and how they differ based on a participants' first language and the stereotypicality of the job for which the candidate applied. These results could assist women with accents in the workplace and add information on intersectionality of gender, ethnicity, and accent discrimination. People with foreign accents are regarded as less hirable for certain jobs in comparison to those with American accents. In this study, participants with either English or Spanish as a first language will evaluate a female candidate who has/does not have a Hispanic accent for a stereotypical or nonstereotypical job.

35. Ava Martinez / Jami Martin-Trainor / Landon McPike (UI)
Hometown: Kansas City, MO / Cedar Rapids, IA / Waukee, IA
Major(s): Political Science, Ethics and Public Policy
Mentor(s): Nicholas Martini

Expanding Rail Infrastructure in Iowa

In the past two decades, the Iowa Department of Transportation and state government have considered expanding passenger rail services, but these policies have struggled to gain necessary support. This article examines the reasons behind this lack of support, explores the implementation of passenger rail in other rural states, and discusses the benefits of various policies for implementing rail services in Iowa.

Promoting rail services can significantly benefit Iowans, especially in addressing brain drain by keeping residents in the state after graduation. Increased access to public transportation is highly desirable among young people, potentially boosting Iowa's attractiveness to potential residents. Passenger rail also provides an environmentally friendly alternative to driving, reducing carbon emissions from long-distance automotive transit. Despite the broad potential of rail in Iowa, one policy proposal stands out: expanding Amtrak services. This proposal provides a solid foundation for implementing supplementary transit policies and improving transit access for all Iowans.

36. Riley McCoy (UI)
Hometown: Long Grove, IA
Major(s): Biomedical Sciences
Mentor(s): Catherine Marcinkiewcz

Tau pathology leads to increased activity of noradrenergic neurons, contributing to early Alzheimer's disease

According to the Alzheimer's Association, 11% of adults the age of 65 or older live with Alzheimer's disease (AD) in Iowa. A key factor in AD is the buildup of abnormal tau proteins (p-tau) in the locus coeruleus (LC), a small region in the brainstem that contains noradrenergic (NA) neurons regulating behavior and sleep. In this study, we examined how p-tau affects LC NA activity. By introducing p-tau into these neurons in mice, we found that the neurons became more excitable. After 4 and 8 weeks,

neurons with p-tau fired more frequently. At 8 weeks, these neurons also responded more strongly to electrical stimulation. This suggests that p-tau may cause early changes in brain activity, which could affect behavior and sleep in early AD. Further research is needed to understand the implications of these changes over time.

37. Lizbeth Montalvo (UNI)
Hometown: Des Moines, IA
Major(s): Political Communication/Pre-Prof: Law/Spanish
Mentor(s): Elise Dubord

Three youth, three experiences with Spanish as a heritage language

This research focused on language maintenance among generation two (G2) Spanish speakers, examining their motivators, at-home interactions, and educational influences. Three participants, all relatives living within a four-mile radius, were individually interviewed via FaceTime. Despite their shared family background, their Spanish proficiency varied, correlating with their educational experiences. Participant 1, who attended a full Spanish immersion program, reported high proficiency and comfort speaking at home. Participant 2, with limited immersion exposure, considered his proficiency moderate and in need of improvement. Participant 3, lacking access to immersion or heritage programs, felt his proficiency was low and avoided speaking Spanish at home. Despite these differences, all participants shared similar motivations, both personal and professional, for maintaining their heritage language. They also expressed a strong desire to pass Spanish on to future generations, emphasizing its cultural and practical significance. This study highlights the impact that education, motivators, and family support have on language retention.

38. Cameron Moore (UI)
Hometown: Cedar Rapids, IA
Major(s): Biochemistry and Molecular Biology
Mentor(s): Yuriy Usachev

Investigating the Effects of Neuronal Deletion of the Mitochondrial Calcium Uniporter (MCU) in Mouse Models of Neurodegeneration

Neurodegenerative diseases are some of the most debilitating issues our society faces, disproportionately affecting the elderly. Among these, dementia and epilepsy are diseases with few therapeutic options available.

A hallmark of neurodegeneration is neuronal loss, and calcium homeostasis is crucial for proper cell function and survival signaling. Our lab investigates the role of the Mitochondrial Calcium Uniporter (MCU), the dominant calcium transporter into the mitochondria, in neurodegeneration. Specifically, this presentation focuses on the impact of neuronal MCU deletion on epileptic activity and tauopathy, which is known to be an indicator of dementia. It also shows how MCU deletion in neurons affects the structure of microglia, which is associated with the immune health of the brain. Further understanding of the MCU shows promising potential for future therapeutics to help those affected by the devastating realities of epilepsy and dementia.

39. Asher Motes (UI)
Hometown: Plymouth, MN
Major(s): Chemistry, English and Creative Writing
Mentor(s): Emma Markun

Solving without solutions: a mechanochemical approach to nuclear fuel recycling.

Nuclear energy uses uranium dioxide to generate heat and produce electricity. During the process of generating nuclear energy, the uranium in the fuel cells looses energy and sometimes becomes other compounds. The spent fuel is then recycled. the by-products, called fission products, are separated from the uranium. Within the nuclear fuel recycling process, a portion of the waste created is liquid waste. One way to reduce this waste is to use a kind of reaction that takes less liquid to remove the fission products. In mechanochemistry, the work of the liquid is done by a ball mill where powder is shaken and collisions between steel balls causes the reactions. My research is looking at the reactions of nuclear fuel by-products under these conditions, so we can explore new ways to separate fuel by-products from reusable uranium.

40. Sara Petersen (UNI)
Hometown: Des Moines, IA
Major(s): Communication Disorders/Spanish
Mentor(s): Elise DuBord

Linguistic representation in the public library of Cedar Falls: Successes and recommendations

The purpose of this study is to determine whether Cedar Falls Public Library (CFPL) is currently providing linguistically and culturally equitable services and resources to all patrons, including monolingual-Spanish speaking and multilingual clients. Data was collected from CFPL through photographs taken of displays during Hispanic Heritage Month (September 2024) and again two months later (November 2024), interviews with librarians about linguistic access, and an exploration of the CFPL website for physical and electronic resources in Spanish. This study found that compared to other multilingual local library programs and collections across the country, CFPL has room for improvement. While this study examines one library in one community, the findings of this study highlights the need for more examination of local library programs and collections, ensuring that all patrons are being adequately and equitably served, regardless of the language they speak.

41. Daniela Pintor-Mendoza / Brenda Ramirez (UI)
Hometown: Des Moines, IA / Round Lake Park, IL
Major(s): Political Science & Intl Relations / Political Science
Mentor(s): Julianna Pacheco

The Iowa Vital Voices Project: Designing participatory action research to promote Latino civic engagement, political voice and community health

The Iowa Vital Voices Project is a community-driven research initiative that uplifts Latino voices, experiences, and data to advance civic engagement and health in Iowa. With prior support, including funding from the Robert Wood Johnson Foundation, the project has made significant progress in transforming community-engaged research, building trust, and developing a deeper understanding of how communities utilize their civic power. Through data analysis, storytelling, and community surveys, we empower communities to shape their own narratives, inform decision making, and drive meaningful change.

42. Samantha Robinson (UNI)
Hometown: Cedar Rapids, IA
Major(s): Communication Disorders
Mentor(s): Sarah Diehl

Preliminary Findings for Conversational Synchrony in Early Huntington's Disease Patients

The purpose of this thesis is to contribute to ongoing research on conversational synchrony abilities in patients with premanifest and early Huntington's Disease (HD). Along with reviewing the symptoms associated with HD and highlighting the presence of cognitive communication disorders within this population, an appropriate data collecting method, the Mediated Discourse Elicitation Protocol, will be described in order to best understand the research within this thesis. More specifically, the study focuses on conversational synchrony, which is defined by Gordon et al. (2015) as the coordination of verbal and nonverbal behaviors between participants in a conversation. This research analysis will include evaluating and scoring speech samples, comparing results, and further studying the topic through related literature. The importance of this research lies in its ability to further understand HD, its progression, and its specific impact on everyday communication and speech abilities.

43. Laura Mariana Santos Correa (ISU)
Hometown: Belo Horizonte, Brazil,
Major(s): Chemical Engineering
Mentor(s): Ratul Chowdhury

Robust Prediction of Enzyme Variant Kinetics with RealKcat

Mentor: Ratul Chowdhury, Chemical and Biological Engineering
Accurate prediction of kinetic parameters is crucial for understanding known and tailoring novel enzymes for biocatalysis. Current models fail to capture mutation effects on catalytically essential residues, limiting their utility in enzyme design. We grid-search through ten neural architectures (25,671 hyperparameter combinations) to identify a gradient-based additive framework called RealKcat. It is trained on 27,175 experimental entries curated manually (KinHub-27k) by screening 2,158 articles. Clustering k_{cat} and K_M values by rational orders of magnitude, RealKcat achieves ≥ 85% test accuracy, demonstrating highest sensitivity to mutation-induced variability thus far, and is the first model to demonstrate

complete loss of activity upon deletion of the catalytic apparatus. Finally, state-of-the-art k_{cat} validation accuracy (96%) on PafA mutant industrial dataset confirms our model's generalizability in learning per-residue catalytic relevance.

44. Niall Sharma (ISU)
Hometown: West Des Moines, IA
Major(s): Computer Science
Mentor(s): Snow Gray

The Potential of Emotions Geogame: Mapping Emotions for Improving the Evaluation of Places

This research is meant to explore how to develop and use location-based games to capture emotions related to locations or places. This research is built on pre-existing research on mapping emotions, GIS analysis of places, and location-based games like Pokémon Go and Pikmin Bloom. This project is meant to explore the development of geogames that lead to real world benefits and gameplay outcomes that help better the understanding of places. Our research fills a gap within location-based research, as emotions tied to specific places have not been thoroughly researched using a gamified geogame. Concepts and ideas were refined through an iterative process throughout the development of this project. Crucial design choices were made during the creation of the first prototype. Some of the important choices were the introduction of the game loop and selecting emotions that the players could choose from to describe their current emotional state. Our first prototype shows the basic functions required to accurately collect emotions related to places. The prototype includes a functional map, an interface to log 6 predetermined emotions, and an integrated backend server meant to serve as a database for the data collected by the app. The emotions we chose were built on prior research and are composed of joy, tranquility, trust, worry, anger, and regret. Our next prototype will be able to tie emotions to specific characteristics of the environment surrounding the player. Our research has the potential to better our understanding of places and the potential helps architects and civil planners understand better what emotions are associated with specific features of locations. This has the potential to lead to better planning of our urban environments.

45. Bhoomika Shettigar (UI)
Hometown: Cedar Falls, IA
Major(s): Psychology
Mentor(s): Ece Demir Lira

Relations Between Green Space Access and Children's Cognitive Performance

Nature's impact on well-being has become an increasingly important aspect of the discussion surrounding children's cognitive abilities. Research emphasizes the benefits of recess (access to outdoor space) on children's learning and mental health (McCormick, 2017), but little is known about long-term green space exposure. To explore this, we studied pre-term children (ages 4-5) in Iowa, using the Child Opportunity Index to assess environmental factors, including green space access. We examined links between green space and cognitive performance (matrix reasoning, similarities, and information). Only matrix reasoning showed a significant correlation, but this disappeared after controlling for walkability. Now, we are distinguishing between usable (e.g., parks, trails) and unusable green space (e.g., cornfields) using open street map data to refine access measurements. Our findings contribute to understanding green space's role in child development.

46. Chloe Smith (ISU)
Hometown: Urbandale, IA
Major(s): Biochemistry and nutritional science
Mentor(s): Melha Mellata

Targeting Antimicrobial Resistance Genes Using Dietary Zinc

Mentor: Ratul Chowdhury, Chemical and Biological Engineering
Accurate prediction of kinetic parameters is crucial for understanding known and tailoring novel enzymes for biocatalysis. Current models fail to capture mutation effects on catalytically essential residues, limiting their utility in enzyme design. We grid-search through ten neural architectures (25,671 hyperparameter combinations) to identify a gradient-based additive framework called RealKcat. It is trained on 27,175 experimental entries curated manually (KinHub-27k) by screening 2,158 articles. Clustering k_{cat} and K_M values by rational orders of magnitude, RealKcat achieves ≥ 85% test accuracy, demonstrating highest sensitivity to mutation-induced variability thus far, and is the first model to demonstrate complete loss of activity upon deletion of the catalytic apparatus. Finally,

state-of-the-art k_{cat} validation accuracy (96%) on PafA mutant industrial dataset confirms our model's generalizability in learning per-residue catalytic relevance.

47. Kai Smith (UNI)
Hometown: Granger, IA
Major(s): Psychology/ Criminology & Criminal Justice/Pre-Prof: Law
Mentor(s): Elise DuBord

Changes in Iowa's Code Chapters 622A and 622B and Chapter 47 of Court Rules: A reflection of evolving interpreter and translation services in the Iowa judicial system

In 2022, around 7.3% of Iowa's population had Limited English Proficiency (LEP) and the population has been increasing (Iowa State Court Administration, 2022). To determine whether there have been improvements in Iowa's interpretation and translation services for people with LEP, I analyzed the most common changes in Iowa's Code Chapters 622A and 622B and Chapter 47 of Court Rules. The changes showed that improvements were made between 2019 and 2024 by removing discriminatory laws, creating the Language Access Services office, and protecting the right to an interpreter outside the courtroom. Items that were found to need to be updated include eliminating more discriminatory laws, increasing the number of employees in the Language Access Services office, and providing interpretation services during custodial interrogations and juries. These findings indicate that Iowa is on the right path toward efficient and accurate interpretation services and needs to continue on this path.

48. Ashley Stevens (ISU)
Hometown: Des Moines, IA
Major(s): Anthropology B.A & Geology B.S
Mentor(s): Ruki Neuhold-Ravikumar

Food and the Workplace: Origins and Present Usage of Food as a Workplace Bonding Ritual

Food has served as a fundamental component of human interactions and bonds since the dawn of humanity. In the past, meal sharing has been used to develop and promote bonds amongst individuals, providing a feeling of solidarity and acceptance. The onset of the Industrial Revolution has significantly impacted how people view meal times and interact with

their food. As people began traveling further for their work, the midday meal became a pinnacle part of the workday. In the past fifty years, coinciding with advances in technology and workplace streamlining, meals have become increasingly confined to an employee's individual workplace, eaten in haste and in silence. The shift to primarily solitary dining in the workplace has been associated with negative impacts such as decreases in employee productivity, dwindling job satisfaction, and weakened social bonds amongst coworkers. Many researchers linked the act of social eating and food based bonding rituals to both organizational and individual benefits, including increased trust and cooperation within the workplace. Additionally, food based rituals can also serve as a way to break down barriers between managers and employees. However, some studies link some rituals to feelings of forced reciprocity and uncomfortable dynamics. With this in mind, many companies have been cautious as they are reintroducing bonding rituals after the COVID-19 pandemic. In general, these actions demonstrate an overall positive direction within the workplace where employers are seeking to better care for their employees. This paper utilizes a thorough literature review to examine the history and current conditions surrounding workplace food based bonding rituals, and will build upon previous studies about workplace bonding to propose a path forward for reinstating food based bonding rituals in a way that breaks down barriers between management and employees, in order to create more positive relations within the workplace.

49. Hiruni Sumanasiri (UI)
Hometown: Coralville, IA
Major(s): Microbiology
Mentor(s): Kristina Thiel

Identifying Challenges in Establishing Cancer Research Resources in Iowa

Iowa ranks 2nd in the US for cancer, yet the causes of these high cancer rates are not understood. To address this, my research seeks to create tumor "avatars" by collecting discarded tumor tissue from cancer patients undergoing surgery as part of their treatment plan. We have identified several barriers in collecting research samples from patients being cared for at the University of Iowa and are now devising plans to overcome these barriers. Focusing on this region acknowledges the unique factors that may drive the increase in cancer rates in Iowa and will provide a rich research resource to reverse this alarming trend. In addition, these results can be applied to improve access for Iowans to clinical trials.

50. Charles Taylor (ISU)
Hometown: Greenville, SC
Major(s): Physics
Mentor(s): Yuji Furukawa

Ferromagnetic spin fluctuations in the Kagome metal Sc3Mn3Al7Si5 revealed by 27Al nuclear magnetic resonance measurement

Kagome (Japanese basket weave pattern) metals have potential for applications in quantum computing, optical devices, and dissipation-less power lines. $Sc_3Mn_3Al_7Si_5$ (SMAS) with a hexagonal structure (space group $P6_3/mmc$) has been reported to be one of the rare metallic systems with in-plane Mn ions forming the kagome lattice. Magnetic susceptibility, specific heat, and neutron diffraction measurements show no long-range magnetic order down to 1.8 K. To investigate the magnetic and electronic states of SMAS from a microscopic point of view, we have carried out ^{27}Al nuclear magnetic resonance (NMR) measurements in the temperature region between 1.5 K and 300 K. From our analysis using the NMR results of the temperature dependences of the NMR spectrum and the nuclear spin-lattice relaxation time T_1, ferromagnetic spin fluctuations were found to develop with decreasing temperatures, which is consistent with the recent report of ^{27}Al NMR measurements.

51. Casandra Tounjian (UNI)
Hometown: Sioux City, IA
Major(s): Mathematics Teaching
Mentor(s): Catherine Miller

Artificial Intelligence's Potential in Assessments of Math Learning

It is well known that Artificial Intelligence (a.k.a. AI) has taken the educational world by storm. Notably, there is discourse around whether AI should be incorporated into classrooms. This analysis of AI's potential is conducted through the perspective of a soon-to-be mathematics teacher. This lens is further narrowed around assessments. Assessments– think practice problems or tests– are integral for evaluating a student's math learning. The intersection between assessments in math classrooms and AI tools was examined through qualitative research, including literature analyses and expert interviews. AI appears to be quite a powerful tool when used responsibly and intentionally.

52. Catrina Tounjian (UNI)
Hometown: Sioux City, IA
Major(s): Biology: Biomedical/Public Health/Pre-Medicine
Mentor(s): Disa Cornish

Accessibility to Menstrual Products at the University of Northern Iowa

Period poverty is the inability to access menstrual products due to economic vulnerability. In the US, 1 in 5 menstruating students miss school due to period poverty. Educational disparities that derive from period poverty must be investigated. At the University of Northern Iowa (UNI), a student-led initiative aims to reduce academic barriers created by period poverty. Within one semester, nearly 3,000 tampons and 2,500 pads were distributed across 17 academic buildings. This study evaluates the impact of free menstrual products on campus by analyzing usage and student feedback, revealing a positive effect on academic attainability. However, the initiative's sustainability is threatened by its reliance on a volunteer model. To address this, the study examines menstrual product distribution systems at comparable institutions and offers recommendations for improving UNI's program. While the initiative has shown promise in reducing educational disparities, further investment is necessary to ensure its long-term success.

53. James Valentin / Malvika Khadiya / Austin Sachtschale (UI)
Hometown: Wheaton, IL / Cedar Falls, IA / Cedar Rapids, IA
Major(s): Ethics and Public Policy / Political Science,
Russian, Ethics & Public Policy / Political Science, Economics
Mentor(s): Frederick Boehmke

Reviving the Past: Analyzing Unexplored Public Opinions from 1974 Des Moines, Iowa

Iowa Public Opinion and Policy Lab is a team of 20+ undergraduate students at the University of Iowa dedicated to exploring previously lost public opinion polls conducted among Iowans from 1946 to 1981. The team analyzes and organizes the data, translating the survey results into comprehensive research reports. This year's focus is a July 1974 survey. Students selected topics with contemporary relevance, such as US healthcare and inflation. They also looked at Iowans' opinions on Watergate, the 1976 presidential election, and the top problems facing the

US. Students have completed converting the survey data from printed formats to digital text, cleaning the data, and preparing it for analysis. They are now in the process of analyzing the refined data and producing detailed reports alongside data visualizations reporting findings from the data. These findings will be presented alongside an explanation of the data preparation process and a summary of key insights.

54. Olivia Van Meter (UNI)
Hometown: Guthrie Center, IA
Major(s): Biology/Pre-Prof: Physical Therapy
Mentor(s): Terence Moriarty

The effects of short-term, high-dosage creatine supplementation on cognitive measures following mental fatigue in healthy young adults: a pilot study

PURPOSE: To examine the effects of high-dosage creatine supplementation before performing a mentally fatiguing task on measures of cognition, and whether these changes are associated with alterations in prefrontal cortex oxygenation.

METHODS: Participants were randomized to receive CR or a placebo for 10 days. Participants completed cognitive tests on two occasions before and following supplementation. A functional near-infrared spectroscopy device was used to measure PFC O2Hb during the cognitive evaluation.

RESULTS: CR had no significant effect on accuracy or response time during the Stroop task or in cognitive domains measured during the CNSVS test. The PFC displayed no significant change in O2Hb across the assessment.

CONCLUSION: Our findings suggest that high-dosage CR supplementation has no significant effect on the measures of cognitive performance. Although not significant, there was a trend for decreased PFC O2Hb and a quicker response time during the Stroop task in the CR versus the PLA group.

55. Anurag Verma (ISU)

Hometown: Delhi, India,
Major(s): Computer Science
Mentor(s): Anuj Sharma

Navigation System for Snowplow in Low Visibility

Snowplows are essential for maintaining safe road conditions during winter storms, yet their effectiveness can be severely impacted by low visibility due to heavy snow, fog, or blizzards. This research introduces a cutting-edge navigation system aimed at enhancing snowplow operation under such adverse conditions. The system integrates radar and GPS data to provide real-time geo-location tracking, ensuring that the snowplow can operate accurately and efficiently even when visual references are obscured.

In addition to geo-location tracking, the system incorporates advanced sensor technologies to detect obstacles and terrain changes, ensuring the snowplow can safely navigate through challenging environments. The integration of a Lane Departure Warning System (LDWS) further strengthens the system's safety features by alerting operators to unintended lane shifts, reducing the risk of accidents.

The project also addresses the challenges of maintaining snowplow performance in extreme weather, with an emphasis on reliability and accuracy. By using radar for collision detection and GPS for precise positioning, the system significantly enhances situational awareness for operators. The study demonstrates the potential of this technology to improve snowplow navigation, reduce operational risks, and ultimately enhance road safety during winter storms. This research contributes to the development of intelligent transportation systems that can withstand harsh environmental conditions, offering a promising solution for winter road maintenance in regions prone to severe weather.

56. Claire Widmer (UNI)
Hometown: Iowa City, IA
Major(s): Biology: Ecol, Evoltn, Organismal
Mentor(s): Ai Wen

The impact of emergency haying on grassland birds in the Conservation Reserve Program habitats of northwest Iowa

Data was collected on breeding grassland bird communities in northwest Iowan Conservation Reserve Program (CRP) fields. Within those fields, CRP grasslands in drought areas could be hayed or grazed for emergency management to harvest supplemental forage for livestock. We compared the bird communities in emergency hayed versus undisturbed grasslands to understand how the drought induced emergency haying affected the grassland birds. Using distance sampling, we found that significantly higher bird richness was found in undisturbed habitat areas compared to the emergency managed hayed areas in the same CRP parcel. In addition, we found that bird density in the emergency managed areas was marginally lower than in the undisturbed areas.

57. Hannah Williamsen (UI)
Hometown: Davenport, IA
Major(s): Human Physiology
Mentor(s): Marco Hefti

Incidence of early neurodegenerative disease pathology in a forensic cohort.

Alzheimer's disease (AD) tau pathology often begins in the brainstem decades before symptoms, but its true incidence remains unclear due to reliance on brain-bank cohorts of natural deaths. This study systematically characterizes AD-related pathology in brainstems from a forensic cohort in Iowa. Postmortem samples from 12 asymptomatic cases (6 male, 6 female; median age 51, range 25–74) were analyzed using immunohistochemistry for tau (AT8), α-synuclein, and beta-amyloid in the dorsal raphe (DR), locus coeruleus (LC), and hippocampus (HPC). Tau pathology was detected in the HPC (6 cases), DR (5 cases), and LC (5 cases), with additional findings of beta-amyloid and α-synuclein in one 74-year-old case. Our data highlight the rarity of AD pathology in adults under 50 and the value of forensic cohorts for population-representative research.

58. Grace Wood (ISU)
Hometown: Martensdale, IA
Major(s): Nutritional Sciences
Mentor(s): Lyndi Buckingham-Schutt

Produce Your Path: A Virtual Nutrition Intervention

Diabetes rates are rising nationwide, leading to serious health complications and high medical costs. In Iowa, over 10% of adults have diabetes and another 34.1% are diagnosed with prediabetes. Nutrition is a key treatment for diabetes, yet only 6.7% of Iowans meet the recommended daily intake of fruits and vegetables, with lower rates among low-income individuals. This highlights the need for a nutrition-focused intervention tailored to low-income patients with diabetes and prediabetes. The Produce Your Path (PYP) intervention is a completely virtual, free nutrition education intervention designed for low-income Iowans with diabetes or prediabetes. Grounded in Self Determination Theory, it aims to enhance participants' feelings of autonomy, competence, and relatedness to increase intrinsic motivation and foster sustainable behavior changes. The six-month intervention covers topics including reading nutrition labels, budgeting, and cooking, with interactive components like goal setting and a community discussion forum. The program is designed to represent a variety of populations, utilizing video actors from diverse backgrounds and offering culturally tailored recipes. In coordination with the Iowa Produce Prescription Program, our study will examine the impact of PYP on nutrition security, psychosocial mediators, and biometric outcomes. The PYP intervention could offer a low-cost intervention to improve their nutrition and overall health status across the state.

59. Isaac Young (UI)
Hometown: North Liberty, IA
Major(s): Geography (Geographic Information Science)
Mentor(s): Susan Meerdink

Using satellite imagery to identify bur oak blight

Bur oak blight, a tree disease caused by a native fungus, has been severely impacting bur oaks in Iowa and other Midwestern states. My research aims to track the spread and geographic distribution of bur oak blight using satellite imagery. I use in-the-field tree surveying coupled with satellite imagery to establish statistical relationships between disease severity and how trees reflect sunlight. Identifying infected trees and measuring the severity of their infection will allow for disease progression and spread to be tracked.

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