

The 13th Annual



Fall Undergraduate Research Festival

Wednesday, November 2, 2022

4:00pm-6:00pm

University of Iowa
University Capitol Centre
2nd floor South Atrium
Iowa City, Iowa

**This event is hosted by the
Iowa Center for Research by
Undergraduates.**

**ICRU promotes undergraduate
involvement in research and creative
projects at the University of Iowa,
serving students, staff, and faculty.**

**ICRU Director
Bob Kirby
bob-kirby@uiowa.edu**

**ICRU Program Coordinators
Melinda Licht
melinda-smits@uiowa.edu**

**Laura Kowalski-Bliss
Laura-Kowalski-bliss@uiowa.edu**

icru.research.uiowa.edu

**6 Gilmore Hall
icru@uiowa.edu**

The 202 Fall Undergraduate Research Festival (FURF) is proud to showcase visual presentations focusing on the research and creative work performed by undergraduates at the University of Iowa. Presenters work in over **40 different departments** and major in over **35 different disciplines**, representing a broad range of sciences, arts, and humanities.

Odd numbered posters will present from 4:00-5:00PM
Even numbered posters will present from 5:00-6:00PM

****Please note that at 5:00, all of the boards will be turned around to show the even numbering and the second hour presenters' posters****

Many thanks to all of the people who make FURF a possibility - all undergraduates presenting their research and creative work, all poster judges, all mentors of undergraduate researchers, the Office of the Provost, the Office of the Vice President for Research and Economic Development, and the ICRU Research Ambassadors.

Programs with full abstracts are available on the ICRU website.

Upcoming ICRU Events and Opportunities

- Excellence in Undergraduate Research Award
- Distinguished Mentor Award
- ICRU Research Fellowships
- Research in the Capitol
- Spring Undergraduate Research Festival (SURF)

4:00 Presentations (Odd-numbered Posters)

1. Morgan Anderson

Major: Biology

Graduation: Spring 2024

Mentor: Dr. Maurine Neiman (Biology)

Genome size in triploid snail

To begin comparing the effect of phosphorus limitation in varying genome sizes of triploid snails (*Potamopyrgus antipodarum*), I performed multiple rounds of flow cytometry to determine genome size. Later this data will be used to set up a dietary phosphorus experiment.

3. Jessica Andrew-Udoh

Major: Biochemistry

Graduation: Spring 2023

Mentor: Dr. Kristina Thiel (OB/GYN)

Gynecologic Tumor Organoid Models for Therapeutic Efficacy

BACKGROUND: Endometrial cancer is the most common gynecologic malignancy. Ovarian cancer, otherwise known as 'the silent killer', is most deadly gynecologic cancer type. There is a lack of preclinical models that replicate human condition compared to other cancer types. Such tools are necessary in order to highlight the efficacy of therapeutic methods

OBJECTIVES: To develop new models of gynecologic cancers using patients' tumors to test therapeutic efficacy.

METHODS: First, we processed tumor tissue into organoid models. Next, we performed drug testing in which organoids were exposed to different chemotherapy drugs at different doses. Finally, we assessed how the organoid models responded using cell viability assays.

RESULTS: Since June 2022, we successfully generated 11 organoid models: 4 endometrial (endometrioid, serous, and carcinosarcoma), 5 ovarian (low and high grade serous, endometrioid, clear cell, and borderline) and 2 benign.

Only 1 model did not successfully grow ex vivo. Two of the ovarian tumors were from recurrent disease. Drug sensitivity studies using standard therapy (carboplatin + paclitaxel) revealed differential responses.

CONCLUSIONS: Organoid models can be created with a high success rate using patient tumors. The differential responses among organoids reflect patient heterogeneity. Future studies will correlate response to therapeutic methods ex vivo vs clinically.

5. Ahmed Baig

Major: Neuroscience

Graduation: Spring 2025;

Mentor: Dr. Hanna Stevens (Psychiatry)

Examination of Dorsal Striatal Cell Density After Prenatal Stress & IL-6 Exposure

Some people with autism spectrum disorder (ASD) display brain volumetric changes, specifically in the dorsal striatum (DS). DS abnormalities are hypothesized to contribute to restrictive, repetitive behaviors seen in ASD, and similar behavioral deficits occur with exposure to PS (prenatal stress, an ASD risk factor) in mice. Our lab has also found increased DS size and MSN (medium spiny neuron) cell density after PS exposure in adult and juvenile male mice, and we are now extending this investigation to newborn (postnatal day 0, P0) mice. Moreover, we are interested in the role of maternal interleukin 6 (IL-6) as a mechanism for these PS-induced changes. These factors were assessed using four groups: Non-stressed (NS)/Saline (Sal), NS/IL-6, PS/Sal, and Naïve. Stereological analysis of these sectioned new-born brain tissue was performed by mounting tissue in DAPI. Average cell densities were 0.00129 cells/ μm^3 (Naïve), 0.00139 cells/ μm^3 (NS Sal), 0.00136 cells/ μm^3 (PS Sal), 0.00123 cells/ μm^3 (NS IL-6). These results imply a lack of significant differences in DS cell density at birth which may signify that observed increases in DS occur through postnatal developmental processes. This warrants further study into the effects of PS on offspring early postnatal development to better understand its mechanism.

7. Kelsey Baller

Major: Post-Bacc Researcher

Graduation: Fall 2020

Mentor: Dr. Michelle Voss (Psychological and Brain Sciences)

Do White Matter Lesions Affect the Relationship Between Cardiorespiratory Fitness and Processing Speed in Aging?

Lower cardiorespiratory fitness (CRF) and higher white matter lesion (WML) burden have each been related to poorer cognitive performance in older adults. Although higher CRF provides a protective effect on cognitive aging, the combined effects of CRF and WML on processing speed specifically, have yet to be determined. In this study we tested whether CRF and WML independently affect processing speed or if WML moderates the effect of CRF on processing speed. CRF was quantified using relative VO₂ max scores, whereas Digit Symbol Substitution Test (DSST) scores were used to quantify processing speed. Cognitively normal older adults (n=91) aged 55-80 years were included in this analysis. A linear regression model was run which included the number of accurately completed items on the DSST as the dependent variable and age, sex, relative VO₂ max, WML volumes and the interaction between relative VO₂ max and WML volume as the predictor variables. Greater age, higher WML volume, and lower relative VO₂ max were each associated with poorer performance on the DSST. However, VO₂ max and WML volume did not interact to predict DSST scores. Our results show that WML and relative VO₂ max independently contribute to processing speed performance in older adults.

9. Elsy Barahona

Major: Public Health, Pre-medicine

Graduation: Fall 2025

Mentor: Dr. Martha Carvour (Internal Medicine)

A Roadmap to Health Equity

Improving access to healthcare is important to achieve health equity. Regrettably, social and vulnerable populations continue to face inequities in healthcare access, resulting in wider disparities of health outcomes. Our project represents the initial phase of identifying and reducing the barriers related to healthcare access. To better understand the barriers, we developed a health equity roadmap for healthcare access guided by Penchasky and Thomas' Five A's of Access theory. Our roadmap presents an ideal pathway to healthcare, while also depicting the roadblocks (barriers) that may impede access. The roadblocks highlight the fundamental causes of social and health inequity that affect access to healthcare. Identifying these barriers is a critical first step in understanding inequities in healthcare access and can guide further qualitative community-engaged research.

11. Liz Barroso

Major: Biochemistry

Graduation: Spring 2025

Mentor: Dr. Ling Yang (Anatomy & Cell Biology)

The Role of Hepatic IRE1 in Protecting the Host During Sepsis

The liver maintains systemic homeostasis through immuno-metabolic responses for surviving sepsis, a frequent cause of intensive care mortality. Prior knowledge that anti-inflammatory therapies lack to improve survivability in patients urges the need for sepsis understanding through metabolic adaptations. The liver plays a central role in providing lipids as energy substrates to support heart function during sepsis. Inositol-requiring enzyme 1 (IRE1) is a protein which regulates liver lipid metabolism and is necessary for liver lipid secretion. However, the extent of IRE1-dependent crosstalk between the liver and the heart is unknown during sepsis. Therefore, we hypothesize that hepatic IRE1 is crucial for liver-mediated lipid secretion, which supports septic heart function. We measured the IRE1 level in the liver and found that sepsis decreased its expression. Its deletion sensitized mice to sepsis-associated heart dysfunction, and their mitochondrial respiration was reduced along with increased immune cell infiltration in the heart. In addition, we found that IRE1 regulates secretion of liver lipids in response to sepsis, and its deletion greatly altered the circulatory lipid profile. Finally, we demonstrated that these lipids protect cardiomyocytes against sepsis-associated mitochondrial and calcium dysfunctions. Overall, our study provides an insight that disruptions of hepatic IRE1-mediated lipid regulation impair sepsis-associated cardiac adaptation.

13. Ferris Bissen; Lizzie Van Es

Majors: Chemistry; Pharmacy Interest

Graduation: 2024; 2027

Mentor: Scott Shaw (Chemistry)

Microbial Growth on Disposable Masks: How Gross are They?

With the prevalence of the COVID-19 virus during the 2021-22 school year, the University of Iowa provided free disposable masks in all academic buildings and dorms. The widespread use of these masks by university students and faculty, combined with significant handling and storage variations, led to questions about mask cleanliness. We investigated the cleanliness of these masks by testing for bacterial growth on their surfaces. Over the course of a month, we collected weekly mask samples from five locations on campus which were strategically selected to include both high- and low- foot-traffic areas as well as indoor and outdoor locations. Each mask was swabbed onto nutrient agar plates and the bacterial growth was examined after a week of incubation. The bacteria grew in distinct, single colonies, and our results are quantified via the number of growths on each dish. The data showed a significant difference in the number of growths between locations. Our results indicate that foot-traffic plays a leading role in determining the number of bacterial growths on masks. We also theorize that exposure to the elements and air quality play a role in the number and type of bacteria present on masks.

15. Ethan Bley

Major: Environmental Science and Geoscience

Graduation: Spring 2024

Mentor: Dr. Jonathan Adrian (Earth and Environmental Sciences)

Encrinuridae Trilobites from the Late Ordovician Maquoketa Formation of Northeast Iowa.

The Maquoketa Formation, found in outcrop in Eastern Iowa, contains several species of trilobite belonging to the Family Encrinuridae. The trilobites of this family, like most trilobites, were likely motile and benthic detritivores, living in carbonate shallow marine environments. The family consists of four sub-families, the two most prominent of which are Cybelinae and Encrinurinae. Two species of importance, *Cybeloides iowensis* (Slocum 1913) and *Encrinuroides pernodosus* (Slocum 1913), belonging to the subfamilies Cybelinae and Encrinuridnae respectively, were both discovered in the Maquoketa Formation. Neither species has been photographed using modern means and both have been significantly understudied. *Encrinuroides pernodosus* lacks any meaningful treatment beyond Slocum's initial description and photography, and the quality of the photography is far below modern standards. *Cybeloides iowensis* has received more discussion in the modern literature due to its status as the type species of the *Cybeloides* genus yet remains poorly known. This project aims to obtain new data through the photography and morphological analysis of the new collections made by vocational paleontologists Calvin Leverson and Arthur Gerk that

were recently donated to the University of Iowa's Paleontology Repository. These new data will be used to revise and reillustrate the species, reconstruct their evolutionary relationships using quantitative analyses, and adjust the taxonomy of the family.

17. Solange Bolger

Major: Psychology

Graduation: Spring 2023

Mentor: Dr. Teresa Treat (Psychological and Brain Sciences)

College-Aged Men's Beliefs about Sexual Consent: Links to Sexual Aggression

Male-initiated sexual aggression towards female acquaintances is a widespread phenomenon on college campuses. This study investigated college men's sexual-consent beliefs and the accuracy of their perceptions of their peers' consent-related beliefs (CRB). We also examined the association between CRB and various risk factors for sexual aggression (i.e., a self-reported history of aggressive behavior or endorsement of rape-supportive attitudes). A large sample of college men at three universities (n=1281) reported their level of agreement with three CRB about the importance of sexual consent (e.g., "I believe that sexual consent is important"). They then indicated how they thought the "typical college male" would respond to the three questions. Finally, they completed measures of rape-supportive attitudes and past sexual aggression. On average, college men endorsed highly favorable beliefs about the importance of sexual consent, and they moderately underestimated their male peers' endorsement of CRB. Men at greater risk of sexual aggression showed less favorable endorsement of CRB and greater under-perception of peers' CRB. The current findings are broadly consistent with existing literature. Future research should examine the effectiveness of providing corrective feedback to college men on their peers' consent-related beliefs, given the importance of perceived peer attitudes and behavior to college men's sexual behavior.

19. Delaney Catania

Major: Biochemistry

Graduation: Spring 2023

Mentors: Nicholas Hammons and Dr. Ernesto J Fuentes (Biochemistry and Molecular Biology)

Structure Determination of the Staphylococcal aureus SrrB Histidine Kinase Cache Domain

Two-component regulatory systems (TCS) are mediators of signal transduction, and are responsible for detecting the extracellular environment which allows a bacteria to elicit an adaptive response. TCSs are composed of a transmembrane sensor histidine kinase (SHK) to sense the extracellular environment, and a response regulator (RR) that functions as a phosphorylation-activated switch that mediates an output in bacterial

response. In the bacterium *Staphylococcus aureus*, the SrrAB two-component system is responsible for regulation of virulence factors, and survival of the pathogen under varying conditions of oxygen availability. However it remains unknown what signals the SHK (extracellular) Cache domain recognizes and responds to. Herein, I will be investigating the signals the extracellular sensing domain (Cache) of SrrB histidine kinase binds to on a structural basis. Via crystallography, the final product is expected to be a crystal structure that enables visualization of the ligand binding pocket of SrrB Cache. Future directions include experimentation with small molecular weight ligands, in order to observe the relationship between potential ligand binding and SrrAB activation or inhibition.

21. Kiley Christopher

Majors: Biochemistry, Neuroscience

Graduation: Spring 2025

Mentor: Dr. Yuriy Usachev (Neuroscience and Pharmacology)

The Role of C5a and C5aR1 in Pain Sensitization

Chronic pain affects approximately 100 million Americans and only a minority of patients experience satisfactory relief of their pain with currently available pharmaceuticals. One type of chronic pain is caused by direct injury to the nerve called neuropathic pain, and it affects ~10% of the overall population. Despite the prevalence, the underlying mechanisms of neuropathic pain are not well-defined, and better understanding of the mechanisms that promote central sensitization after injury could lead to better treatment of this condition. Notably, a recent meta-analysis of microarray studies of pain-related genes demonstrated a remarkable enrichment of genes related to the complement system activation. Among the complement products, C5a seems to be especially important in the pathogenesis of neuropathic pain. C5a and the receptor for C5a, C5aR1, are upregulated in the spinal cord after peripheral nerve injury, and selective C5aR1 antagonists (PMX205, JPE1375) produce analgesia in a mouse model of neuropathic pain. When C5a is generated, C5aR1 is activated on glia, this in turn activates phagocytosis and releases inflammatory factors. Previous literature suggests that C5a levels increase in the tissue, spinal cord, and plasma following injury. A model of neuropathic pain, spared nerve injury (SNI), was used to induce hyperalgesia in C57BL6 mice. A mechanical stimulus, the Von Frey method, was used to test reaction to an innocuous stimulus both before and after surgery.

23. Phoebe Dillard

Majors: History, English and Creative Writing

Graduation: Spring 2023

Mentors: Drs. Alyssa Park and R. Tyler Priest Department of History (History)

Wavering Divisions: The Fluctuation of Gender Divides in British Civil Defense During World War II

This thesis examines the militarization of the domestic sphere through the avid recruitment of female volunteers for civil defense organizations in Great Britain during World War II. It demonstrates the tensions between the exigencies of war and the desire to uphold traditional gender norms on the home front, and how this affected women's participation in civil defense over the course of the war. The passing of the Air Raid Precautions Act in 1937 incited the recruitment of women in response to the mounting threats brought to the home front by modern aerial warfare. Women were actively recruited for participation in civil defense initiatives and broke gender divisions in the workplace, taking on traditionally masculine roles and even leadership positions. Yet, women's advancement in civil defense was restrained to preserve the masculine nature of defense organizations and not alienate male volunteers, of which there was a chronic shortage; conventional gender boundaries had to be continually reinforced to "masculinize" civil defense organizations. This thesis makes use of civil defense recruitment posters, women's letters, newspaper articles, Home Office records, and parliamentary proceedings to track this militarization of the domestic sphere in Britain during World War II and the effects it had on women's participation in civil defense initiatives.

25. Allison Eagen

Major: Biomedical Science

Graduation: Spring 2023

Mentor: Dr. Hildegard Janouschek (Psychiatry)

CNTNAP2 deficiency leads to reduced parvalbumin reactivity in the basolateral amygdala of adult mice.

Comorbid fear and anxiety-disorders cause serious impairment in many individuals with autism spectrum disorder (ASD), which cannot be treated to a satisfactory degree. Better understanding of ASD-specific pathophysiology of fear-processing is essential to develop better therapies. Preliminary data on the CNTNAP2 mouse model, relevant to ASD, showed age-specific alterations in fear-related behaviors in adult mice. Parvalbumin positive (PV+) interneurons in the basolateral amygdala (BLA) are important for fear learning and fear memory retrieval. Additionally, PV+ interneurons are thought to play an important role in ASD pathophysiology. Therefore, we hypothesized to find decreased parvalbumin reactivity in the BLA of adult CNTNAP2^{-/-} mice. We performed immunohistochemistry and stereology to determine parvalbumin reactivity in the BLA of CNTNAP2^{-/-} mice and wild type controls. In line with our hypothesis our preliminary data showed a reduction of parvalbumin reactivity in CNTNAP2^{-/-} mice. Interestingly, this was not due to a reduction in total neuron number or BLA size. Given that parvalbumin expression in PV+ interneurons is essential for their normal function, the impaired parvalbumin reactivity might cause the fear conditioning deficits we observed in our behavioral studies.

27. Melanie Flores

Major: Speech and Hearing Science

Graduation: Spring 2025

Mentor: Dr. Kristi Hendrickson (Communication Sciences and Disorders)

Lexical access in school-age bilingual: a study of bilingual vocabulary development

There is a well-documented relation between speed of word processing and vocabulary development, such that children who know more words are faster at processing words. However, far less is known about this relation in bilingual children, especially regarding written word recognition. The present study examines the relation between speed of word processing and vocabulary knowledge within and across languages in school-age bilinguals. We tested 16 11-13-year-old English-Spanish speaking children who were enrolled in a dual language immersion program. Participants' receptive vocabulary was measured using the Peabody Picture Vocabulary Test (5th edition) and speed of word processing was measured using the Visual World Paradigm. For this paradigm, participants heard or read a word in English or Spanish and were instructed to click the image of the word they heard out of an array of four images. We measured reaction time from the presentation of the word to their click response. Consistent with work on spoken word recognition in bilingual toddlers, cross-language associations in school-language bilinguals suggests that the vocabulary in the dominant language supports processing in the nondominant language. This is in line with the common underlying proficiency model which suggests that the two languages of bilingual speakers interact.

29. Daniel Fu

Major: Biomedical Sciences

Graduation: Spring 2023

Mentor: Rory Fisher (Neuroscience and Pharmacology)

A splice acceptor variant in RGS6 associated with intellectual disability, microcephaly, and cataracts disproportionately promotes the expression of a subset of RGS6 isoforms

Individuals with intellectual disabilities (ID) have an increased risk of developing psychiatric disorders. Of interest is regulator of G protein signaling 6 (RGS6), which is associated with numerous psychiatric disorders. RGS6 is a highly conserved gene that undergoes complex alternative mRNA splicing, that has been studied with a global approach in functional studies. Recently, we addressed this deficiency through a comprehensive analysis of RGS6 isoform expression. Using novel antibodies, we demonstrated that RGS6 is most highly expressed in the CNS and that RGS6L(+GGL) isoforms predominate. A recently identified genetic variant in intron 17 of RGS6 (c. 1369-1G>C) is associated with ID, offering insight to isoform functionality. This variant is predicted to alter a highly conserved canonical 3' acceptor site creating an alternative branch point within exon 18 (including in a subset

of RGS6L(+GGL) transcripts) and a frameshift mutation forming an early stop codon. Here, we show that the c. 1369-1G>C variant disrupts the canonical, preferred (>90%) intron 17 splice site and leads to the exclusive use of the alternative exon 18 splice site, inducing disproportionate expression of a subset of isoforms, particularly RGS6Lfl. ID caused by the c. 1369-1G>C variant likely results from altered RGS6 isoform expression, rather than RGS6 isoform loss.

31. Jason Gao

Major: Biomedical Sciences

Graduation: May 2023

Mentor: Dr. Jennifer Streeter (Internal Medicine)

The Role of ATF4 in the Favorable Metabolic Phenotype of OPA1 Skeletal Muscle KO Mice

Optic Atrophy 1 (OPA1) is an inner mitochondrial membrane protein that serves a critical role in regulating whole-body metabolism. Prior studies have shown that knockout of muscle-specific OPA1 (mOPA1 KO) in mice models manifests as protection from diet-induced obesity as well as insulin resistance. Importantly, these mice models also demonstrate elevated endoplasmic reticulum stress, leading to increased expression of Activating Transcription Factor 4 (ATF4) and increased secretion of muscle-derived fibroblast growth factor 21 (FGF21), both of which play a role in the unfolded protein response. It has already been demonstrated that knocking out FGF21 with OPA1 eliminates the favorable metabolic phenotype of mOPA1 KO mice, suggesting that FGF21 plays a critical role in manifesting protection from diet-induced obesity and insulin resistance. Interestingly, ATF4 is known to regulate FGF21 levels in other models. As such, this study aims to explore the degree to which ATF4 regulates FGF21 in skeletal muscle to see if its presence is necessary for the favorable metabolic phenotype of mOPA1 KO mice.

33. Nathaniel Gehrke

Majors: Chemistry, Mathematics

Graduation: Spring 2023

Mentor: Dr. David Wiemer (Chemistry)

Conjugate Reduction of Vinyl Bisphosphonates

Geminal bisphosphonates are a class of molecules known to combat the loss of bone density, allowing them to be explored as treatments for conditions such as osteoporosis, Paget's disease, and multiple myeloma. A typical method of synthesizing bisphosphonates first involves the preparation of the analogous vinyl bisphosphonate via a Knoevenagel condensation of a tetraalkyl methylenediphosphonate and a carbonyl compound. To convert to the bisphosphonate the olefin must be reduced, which is typically done using common methods such as catalytic hydrogenation. However, these methods are not selective in their reduction of olefins and thus also would reduce other olefins that are present in the molecule. This is problematic for bisphosphonates developed for the potential treatment of multiple myeloma,

for example, as these molecules often include the olefin-containing geranyl or neryl groups. To selectively reduce vinyl bisphosphonates, a novel conjugate reduction method has been developed and demonstrated by applying the reduction conditions to bisphosphonates with various substrates.

35. Noah Gilkes

Majors: Neuroscience, Philosophy

Graduation: Spring 2023

Mentor: Dr. Elizabeth Newell (Pediatrics)

Type I interferon receptor knockout combats neuroimmune activation and rescues behavioral outcomes after traumatic brain injury

Traumatic brain injury (TBI) is a leading cause of morbidity and mortality worldwide, with survivors often experiencing a myriad of neurological deficits that can persist throughout life. The underlying neuropathological mechanisms contributing to these deficits remain understudied and result in a lack of neuroprotective therapies available. The type I interferon pathway signals through the type I interferon receptor (IFNAR) and contributes to neuroinflammation after injury and is one possible explanation for the consequences of a TBI. In our study, adult male C57BL/6J (wild-type) mice underwent either fluid percussion or sham injury. We used IFNAR-deficient mice in comparison to wild-type mice to isolate the contribution of the IFNAR pathway to neuropathology and neurologic dysfunction after TBI. We evaluated the neuroimmune response and behavioral outcomes after injury using multiple gene expression analyses and behavioral testing. We found that IFNAR deficiency rescued behavioral deficits after TBI. We also demonstrated a robust neuroinflammatory response in subjects after TBI which was mitigated in the absence of the IFNAR receptor. Our current studies are further investigating the cell-specific mechanisms of neuroprotection the IFNAR deficient pathway may confer to after TBI and its viability as a potential therapeutic approach for TBI victims.

37. Walter Golay

Majors: Astronomy, Physics

Graduation: Spring 2023

Mentor: Dr. Robert Mutel (Physics and Astronomy)

Beam me up, SCOTTY! New algorithms for characterizing the beams of next-generation CMB experiments

The latest cosmologies predict inflation in the early universe imprinted a signature polarization pattern in the cosmic microwave background (CMB). The BICEP/Keck collaboration aims to detect this unique pattern to constrain inflation models. However, precision CMB measurements such as those carried out by BICEP/Keck telescopes rely on a thorough understanding of instrumental systematics. For example, determining the differential beam between pairs of orthogonal detectors is essential to mitigating the effects of

temperature-to-polarization leakage, a significant source of systematic error. The first step in characterizing the beams is the demodulation of a signal generated by observing a ground-based chopped source. Here we present a summary of previously implemented demodulation techniques and evaluate a new approach called SCOTTY (Systematic Cleaning of TimesTreams Yielding beams). We demonstrate that the existing time-domain kernel algorithm called `square_demod` has systematic, patterned errors intrinsic to the algorithm. SCOTTY circumvents this problem by employing the convolution theorem to perform the demodulation in Fourier space. This approach has the unique benefit of separating the down-sampling of the signal from the demodulation and is not limited to a specific de-convolutional algorithm. We predict that future developments of advanced adaptive kernel weighting schemes and de-convolutional algorithms will improve the benchmarks of each algorithm, respectively.

39. Lauren Groenenboom

Majors: Human Physiology, Enterprise Leadership

Graduation: Spring 2023

Mentor: Dr. Nicole Becker (Chemistry)

A qualitative analysis of undergraduate students' modes of reasoning for organic chemistry reactions

Organic chemistry is a difficult course required for many pre-health students. Organic chemistry students can be better supported by conducting research regarding their thought processes about organic chemistry mechanisms. My research project focuses on the different modes of reasoning students use to support their claims about organic chemistry reactions. All organic chemistry students can be impacted by the results of the research project, including students at Iowa. By analyzing the modes or reasoning students use to solve organic chemistry reaction problems, classroom changes can be made to further support students.

41. Lydia Guo

Major: Biomedical Sciences

Graduation: Fall 2022

Mentors: Drs. John Engelhardt and Idil Apak Evans (Anatomy and Cell Biology)

CFTR-F508del Ferret Model Responds to CFTR Modulator Therapy and Exhibits Mucus Phenotype

Cystic fibrosis (CF) is an autosomal recessive disease characterized by mutations in the cystic fibrosis transmembrane conductance regulator (CFTR) gene with F508del as the most prevalent mutation. This gene encodes the CFTR protein, a crucial ATP-binding cassette transporter and anion channel involved in the movement of chloride and bicarbonate across epithelial surfaces. Common symptoms found in CF patients include the accumulation of viscous, sticky mucus in passageways and ducts due to the inability to properly regulate ion flow. We developed a F508del ferret model to study

how CFTR modulators rescue CFTR function and observe the expression of mucus phenotypes. CFTR correctors, such as lumacaftor, encourage proper CFTR protein folding and trafficking to the cell surface. Using primary airway epithelia and Western blotting techniques, we demonstrate how treatment with lumacaftor can improve ferret CFTR-F508del processing and function. Immunofluorescence staining for MUC5B and MUC5AC mucin protein subtypes was employed to investigate mucin protein expression in lung tissue sections. Quantitative mass spectroscopy methods were used to determine mucin protein levels in ferret bronchoalveolar lavage fluid. These findings suggest that the CFTR-F508del ferret model may be useful for testing therapies, thus allowing us to take steps towards improving medicine for individuals with CF.

43. Claire Haas; Isaiah Pielak

Majors: Electrical Engineering; Political Science, Psychology, Ethics and Public Policy

Graduation: Fall 2025; Spring 2026

Banzhaf Index and the Electoral College: An Analysis of 2020 Census Data

This paper analyzes the extent to which the electoral college system in United States presidential elections disenfranchises and diminishes the voting power of particular geographic populations. In the study, eligible voting bodies are measured by their ability to impact the outcome of the election. We used Monte Carlo simulations, which generate randomly simulated elections where each state has an equal chance of voting for or against the winning president. We then calculated which states were able to "swing" the outcome of the vote from winning to losing to find Banzhaf's power index. To provide a more comprehensive understanding of individuals' power, the same calculations were performed on various populations. The study found significant disparities in voting power between different states, and between their respective residents. With consideration to the recent electoral inversions, we hope to add to the conversation surrounding the electoral college using new data and analysis.

45. Aden Hageman

Major: Physics

Graduation: Spring 2024

Mentor: Dr. Ravitej Uppu (Physics and Astronomy)

Telecom-band single-photon sources

Semiconductor quantum dots are efficient sources of single-photons that could be employed in practical quantum communication. However, conventional quantum dots sources emit in the near-infrared (~950 nm) where the fiber-optic transmission of light is very lossy due to optical absorption. Here, we demonstrate novel quantum dots in gallium antimonide that emit (~1430 nm) near the optimal telecom band, which could therefore enable long distance quantum communication. Through detailed

spectroscopy and photon state characterization, we quantify the quality and intrinsic efficiency of these single-photon sources. Moving forward, we will embed the quantum dots in nanophotonic structures to boost the collection efficiency of photons into an optical fiber.

49. Grace Heft

Major: Biomedical Sciences

Graduation: Spring 2024

Mentor: Dr. Fang Lin (Anatomy & Cell Biology)

Role of Vangl2 in regulating gut-endoderm morphogenesis

The posterior endoderm contributes to the development of the gut and its associated organs. During segmentation, the endodermal sheet gradually narrows to form the gut tube by a process called convergence and extension (C&E), which requires the non-canonical Wnt/Planar Cell Polarity (Wnt/PCP) signaling pathway, a pathway that is also critical for mesoderm C&E. Our recently published work showed that during C&E, endodermal cells exhibit planar polarity that requires Glypican 4 (Gpc4), a heparan sulfate proteoglycan, which modulates Wnt/PCP signaling. The project I participated in over the summer sought to investigate the role of Van Gogh-like 2 (Vangl2, a core Wnt/PCP protein) in regulating endoderm C&E. We found that in vangl2-deficient embryos, the planar polarity of endodermal cells is lost, and endoderm C&E are impaired. Transgenic expression of GFP-Vangl2 in the endoderm does not affect mesoderm C&E. However, its expression at a low level partially rescues endodermal C&E in vangl2 mutants and its expression at a high level disrupts normal endodermal C&E. These data suggest that Vangl2 acts cell autonomously in regulating endoderm C&E. Thus, Vangl2 functions in the endoderm to regulate its morphogenesis. We are working on understanding the molecular mechanisms by which Vangl2 regulates endoderm development.

51. Felipe Herrmann

Major: Psychology

Graduation: Spring 2023

Mentor: Dr. Emily Thomas (Psychological and Brain Sciences)

Educating during the COVID-19 pandemic: The effects of psychological flexibility on depression and anxiety

There have been numerous negative consequences because of the COVID-19 pandemic, both mental and physical. Research focusing on the effects of the pandemic on educators has been limited. Research indicates that educators are at risk for anxiety and depression, so it is important to investigate both the effects of the pandemic on the mental health of educators, as well as potential mitigating processes. Psychological flexibility is one such process that is modifiable and has been associated with lower stress, depression, and anxiety. The current study investigated the role of psychological flexibility as related to

depressive and anxiety symptoms among educators during November and December of 2020. We hypothesized that greater psychological flexibility would contribute to lower depression and anxiety during COVID-19. Our results indicate that increased psychological flexibility is associated with depression and social anxiety. Given that psychological flexibility is therapeutically modifiable, future research should investigate interventions focused on psychological flexibility with educators during the pandemic or amidst other stressful events.

53. Jason Homann; Will Meiners

Majors: Physics, Astronomy; Physics, Astronomy
Graduation: Spring 2025; Spring 2025
Mentor: Dr. David Miles (Physics and Astronomy)

Sensing Oxygen and Nitrogen Composition (SONiC)

Accurate measurements of local atmospheric content enable the study of a number of geophysically important topics, including climate change, heat transfer, and water cycling, which affect the long term viability for life on earth. In an effort to address this need for geographically relevant information regarding Iowa's atmospheric profile, accurate measurements of the relative abundances of diatomic nitrogen (N₂) and oxygen (O₂) gas are required. We propose a mission to fabricate an experimental payload instrument capable of measuring the relative abundances of these gases within Iowa's atmosphere. This mission seeks to compare the global estimations for N₂ and O₂ abundances to that locally of Iowa. This will be achieved by measuring how changes in N₂ and O₂ abundances affect the speed of sound as a function of altitude above Iowa. Additionally, we seek to model how the abundance of water vapor, an atmospheric trace element, affects the presence of N₂ and O₂. The instrument will be delivered on a high-altitude meteorological balloon to be launched from central Iowa, and will monitor sound propagation, altitude, pressure, temperature, and humidity in order to meet these science goals. We intend to complete an analysis that relates these observable parameters to the abundances of N₂ and O₂, as well as compare these abundances to those reported globally.

55. Rongzhuo (Selina) Hua

Majors: Biomedical Sciences, Art
Graduation: Spring 2024
Mentor: Dr. Marlan Hansen (Otolaryngology)

Characterization of the newly discovered lymphatic vascular system of inner ear

Hearing loss is the most common sensory abnormality affecting nearly 40 million Americans. Loss of auditory receptor cells, hair cells, is the most common form of sensorineural hearing impairment. Moreover, damage to and loss of the inner ear synapses between the hair cells and auditory neurons (spiral ganglion neurons/SGNs) has been linked to hearing loss. Such damage to the hair cells and/or the inner ear synapses is associated with activation of

the adaptive immune system, characterized by antigen presentation by antigen presenting cells (APCs) potentially contributing to the pathogenic process of hearing loss. Presence of lymphatic vessels is necessary to facilitate APC antigen presentation and trafficking of APCs to the lymph node. In Hansen lab, we have recently discovered a previously unknown, rich cochlear lymphatic network. During this summer, I will utilize immunohistochemistry and immunofluorescence microscopy on 'cochlear whole mounts' (a technique where the whole cochlea is mounted onto a slide) and sections of cochlea to investigate the spatial organization of lymphatic network within the cochlea. This seminal study will form the basis of lymphatic system biology in inner ear, will potentially lead to therapeutic interventions augmenting hearing preservation, and provide me with training on cutting-edge research on neuroimmune interactions.

57. Madeleine Humpal-Pash

Major: Biomedical Engineering

Graduation: Fall 2022

Mentor: Dr. James Ankrum (Biomedical Engineering)

MSCs: The Future of Drug Delivery?

Human Mesenchymal Stem Cell (MSC) research is continuing to grow. One of the questions which needs to be answered before these cells can be used in a therapeutic and clinical setting is how their interactions with immune cells affect their inflammatory profile. After co-culturing MSCs and peripheral blood mononuclear cells (PBMCs), a t-cell proliferation assay was done to measure the inflammatory profile of MSCs phagocytosed by monocytes. Next steps for this research will be to use PLGA nanoparticles in conjunction with MSCs as a drug delivery method.

59. Mara Jendro

Major: Neurobiology

Graduation: Fall 2022

Mentor: Dr. Queena Lin (Iowa Neurobank Core)

Selective Vulnerability in Von Economo Neurons in Frontotemporal Lobar Degeneration

I'm looking at the CIRBP gene expression in Von Economo Neurons in human tissue. I use an RNAscope experiment to quantify gene expression in these neurons and surrounding neuronal types in FTLD - affected brain tissues and control brain tissues. I hope to find asymmetric expression that could be implicated in selective vulnerability of VENs in this disease, so it can be explored as means of biomarkers, treatment, or prevention.

61. Preston Johnson

Major: Neuroscience

Graduation: Spring 2023

Mentor: Dr. Amanda McCleery (Psychological and Brain Sciences)

Optimal cut scores for the SPQ-BRU to identify psychosis risk in a non-help seeking undergraduate sample: A Multi-site Study

Schizotypy refers to personality characteristics that are associated with a vulnerability for schizophrenia. While many individuals with elevated schizotypy experience subthreshold psychotic-like experiences (PLEs) such as unusual thought content and perceptual aberrations, PLEs are not always associated with distress or impairment. Notably, distressing PLEs are associated with increased risk for a host of negative outcomes, including later development of psychotic illness. However, the relationship between schizotypy and clinically meaningful PLEs is not well understood. The aim of this project was to test associations between measures of schizotypy and PLEs and associated distress. In addition, we aimed to identify cut scores on the schizotypy measure to maximize sensitivity and specificity for identification of individuals with elevated schizotypy and distressing PLEs. Undergraduate students (n = 1644) from three different institutions (University of Iowa, Michigan State University, and Indiana University-Purdue University Indianapolis) completed the Schizotypal Personality Questionnaire-Brief Revised Updated (SPQ-BRU), a measure of schizotypy, and the Prodromal Questionnaire-Brief (PQ-B), a measure of PLEs and associated distress. A negative binomial regression model tested whether SPQ-BRU scores predicted PQ-B total distress scores. Additionally, a receiver operator characteristic (ROC) analysis was used to determine optimal SPQ-BRU cut scores to classify individuals.

63. Jamie Jones

Major: BA Environmental Science

Graduation: Spring 2024

Mentor: Dr. Kate Tierney (Earth and Environmental Sciences)

Plant Distribution at Ashton Prairie Living Laboratory

My research consisted of plotting GPS points along transect lines across the entirety of a 7 acre prairie. With the help of my mentor, I was able to create 10 by 10 meter quadrats. Within those quadrats, I used a 100 by 100 inch pvc pipe rectangle to be able to identify what plants were where in accordance with transect lines. I was then able to determine and compare the plants I found that sprouted from late spring to late summer to the plants that were originally supposed to be planted in the prairie. We will use this information for future years in order to see what kind of conditions certain kinds of plants grow in and what we need to do in order to grow a successful, standard prairie

65. Emily Kalmanek

Major: Human Physiology

Graduation: Spring 2023

Mentor: Dr. Erin Talbert (Health and Human Physiology)

Role of obesity in cancer cachexia

Cancer cachexia is a multifactorial syndrome that includes unintentional weight loss due to the depletion of skeletal and adipose tissue mass. Pancreatic ductal adenocarcinoma (PDAC) patients are of particular interest due to their high incidence and severity of cachexia, which has been associated with lower quality of life, poorer surgical outcomes, and reduced tolerance to radiation and chemotherapy treatments. While obesity is known to be a contributing factor to the development of PDAC, very little is known about the relationship between obesity and cachexia. Body composition of PDAC patients was assessed from serial CT scans taken during routine cancer care. Scan slices were analyzed at the third lumbar vertebra with Tomovision's sliceOmatic software and Automated Body Composition Analyzer using Computed Tomography Image Segmentation (ABACS). Total cross-sectional area and density of skeletal muscle, subcutaneous adipose tissue, and visceral adipose tissue normalized to height were analyzed. Medical record data and CT scans were collected from 204 PDAC patients. 54% were obese (Body Mass Index, BMI \geq 30). The mean pre-illness BMI of obese patients was 36.0 kg/m², with non-obese patients 25.9 kg/m². The mean weight loss was higher in obese compared to non-obese patients (11.7% and 8.4%, respectively, $p=.005$). Next, we will model the rates of change in skeletal muscle wasting and compare between the obese and non-obese groups.

67. Miles Kramer

Major: History

Graduation: Spring 2023

Mentors: Drs. Alyssa Park and Nick Yablon (History)

Forever Conquered: The Changing Significance of Vikings in Modern and Contemporary Anglo-American Culture

This project examines how and why depictions of Vikings in Anglo-American popular culture have shifted between the Victorian era and the present, beginning with their reputation as objects of Britain's evolving racial and cultural identity and ending with their position as subjects of less controversial contemporary entertainment. This transformation reflects the changing social and cultural values of the twentieth century, especially regarding the importance of race and racial exclusion to the protraction of the white regime, and the portrayal of the Vikings throughout this time frame shows how a symbol can be abused or rehabilitated to match the shifting needs of an era. By analyzing works such as Sir Walter Scott's *The Pirate*, Richard Fleischer's formative *The Vikings*, or John McTiernan's turn-of-the-century *The 13th Warrior*, this project will describe the different forms that Viking media has taken across the last two hundred years. Additionally, by linking them to major social, political, or cultural movements throughout this time frame, such as the Victorian 'Old Northernist' movement or the pagan revival of the late twentieth century, it will show how these popular depictions have both influenced and been influenced by the culture that created them, especially during major periods of transition.

69. Ryan Langstraat

Major: Biomedical Engineering

Graduation: Spring 2023

Mentor: Dr. Suresh Raghavan (Biomedical Engineering)

Development Of An Automated Geometric Lung Meshing Tool

Identifying various aspects of the mechanics of lung motion can help clinicians better understand, diagnose, and treat lung disease. An aspect of lung mechanics is sliding between the different lobes of the lungs. Our understanding of the role played by lobar sliding on lung function is poor. Finite Element Analysis (FEA) is a computational tool that allows us to study the effects of lobar sliding by comparing two simulations: one that allows lobar sliding and one that does not. FEA requires a geometric representation of the lungs, called a mesh, to be created from a clinical CT image of the lungs. Meshing is a time consuming and challenging process which takes efforts away from the analysis and limits the number of available subjects. Therefore, the goal of this project is to develop an automated mesh pipeline that will take a clinical CT image input and output a high quality, tetrahedral mesh of the segmented left and right lungs. Furthermore, the mesh pipeline should be optimized to run quickly without impinging on the quality of the mesh or the accuracy of the geometric representation.

71. Dana Lapinski

Major: Neuroscience

Graduation: Spring 2023

Mentor: Dr. Gordon Buchanan (Neuroscience)

Effect of sleep state and time of day on breathing following seizures in amygdala kindled serotonergic deficient mice

Sudden unexpected death in epilepsy (SUDEP) is the leading cause of death in patients with refractory epilepsy. While the exact cause of SUDEP is unknown, abnormalities in breathing or heart rhythms may be involved. Most cases occur during sleep or at night. Serotonin (5-HT) modulates breathing and oscillates across sleep states and times of day, with levels being high in daytime and wakefulness and lowest at night and during sleep. Lmx1b conditional knockout (CKO) mice have 99% of serotonin neurons genetically deleted. We hypothesized Lmx1b CKO mice would have lower postictal ventilation than wildtype mice and that breathing would not change with variations in time of day or sleep state. Wildtype mice would experience worsening of breathing based on time of day or sleep state. To examine the role of serotonin on postictal breathing across different sleep states and times of day, CKO and wildtype mice underwent amygdala-kindling and seizures were induced in either wake, NREM, and REM during the light phase or dark phase. We analyzed breathing data from these trials and looked at differences in the sleep state, the time of day, and genotype. Future studies will examine EKG data from these animals to look at heart parameters.

73. Trevor Larkin

Major: Chemistry

Graduation: Fall 2023

Mentor: Josh Coduto and Kasun Dadallegei (Chemistry)

Preparation and Evaluation of Lanthanide Catalysts for Oxygen Reduction

Catalysts play an important role in chemical reactions, such as speeding up a chemical reaction, or lowering the temperature or pressure needed to start one, without itself being consumed during the reaction. Many lanthanides have catalytic properties, and taking advantage of those properties to perform reduction reactions may play an important role in both the lab setting, as well as industry. The research being conducted investigates the catalytic properties of lanthanum and Ytterbium, in an oxygen reduction reaction. When oxygen is reduced an electron is added to the oxygen atom, and this process is observed by using a technique called cyclic voltammetry. The catalytic ability of a lanthanide is then determined based on the onset potential and peak current that is observed in the cyclic voltammogram.

75. Omdrea Li

Majors: International Relations, Journalism

Graduation: Spring 2025

Mentor: Dr. Elise Pizzi (Political Science)

Disaster, Migration and Violence in Thailand

The project explores how climate shocks influence internal and external security threats that create or exacerbate conflict in different countries from 1990 to 2010. This research analyzes the type of policies a government pursues following a natural disaster and the likelihood of conflict by investigating government response to natural disasters that have occurred in Thailand from 1900 to 2010. To investigate it, I have reviewed existing literature connecting environmental shocks and conflict by gathering news reports and publications from international organizations.

77. Carson Lovig

Majors: Neuroscience, Biochemistry

Graduation: Spring 2025

Mentor: Nicole States and Dr. Renee Cole (Chemistry)

Analyzing STEM instructor classroom facilitation

The use of active learning methods, such as POGIL and Peer Learning, in STEM courses have been shown to promote student learning. However, not all active learning is equivalent, and instructor facilitation is one source of this variation. An analysis of instructor facilitation can elucidate what interactions promote student engagement and positive learning outcomes. Current coding schemes regarding instructor facilitation do not emphasize the

nuances of instructor speech, yet these nuances are of great importance to gaining a deep understanding of how instructor facilitation affects student learning. Using an open coding method, a framework for observing classroom instruction (FOCI) was developed to characterize instructor utterances across both lecture and discussion periods. Additionally, this framework uses a visualization of instructor speech codes that more easily allows for comparison of facilitation across class periods and instructors. A variety of utterance types can be seen in any given question period using FOCI. Furthermore, FOCI can be used in future classroom studies to enhance specificity and offer a new method by which instructor speech can be analyzed.

81. Megan McGovern

Major: Biomedical Sciences

Graduation: Spring 2024

Mentors: Drs. James Byrne and Jianling Bi (Radiation Oncology, Biomedical Engineering)

Extremophile mRNA Delivery for Radioprotection

Cancer patients undergoing radiation therapy may experience severe debilitating short- and long-term toxicities resulting in reduced quality of life and regret of their treatment decisions. These toxicities are bystander effects based on proximity of normal organs to the treatment target and may manifest as gastrointestinal (GI) symptoms, such as oral mucositis, enteritis, colitis and proctitis.

Certain organisms in nature—known as tardigrades—have the ability to withstand extremely large doses of radiation as a result of a tardigrade-unique Dsup protein that prevents DNA damage. We have developed a nanoparticle platform for effective delivery of Dsup-encoding synthetic mRNA in vitro and in vivo. We demonstrate that the synthetic Dsup-mRNA can suppresses X-ray-induced DNA damage and improve radiotolerance of human oral epithelial cells. The local delivery of Dsup mRNA have the potential to reduce short- and long-term radiation toxicities by reducing DNA damage in cancer patients.

83. Jesse Miller

Major: Social Studies Education, History

Graduation: Spring 2024

Mentors: Drs. Alyssa Park and Nick Yablon (History)

"License to do Evil in the Name of Good": Political Radicalization and Rhetorical Adaptation During the Wilmington Coup

This paper seeks to analyze the impact of local political actors on the development of the Wilmington coup of 1898, an event that stands out in American history due to the violent overthrow of a sitting city government. The event has been studied more in recent decades by Prather, Gilmore, and the state of North Carolina, and they tend to focus on the aspects of race and gender that pervaded the buildup to the coup against a government with

African-American civic participation. I build on the existing scholarship to argue that, while white supremacy and gender hierarchy in the South were important to understand in why the participants were convinced to engage in political violence more broadly, the influence that a group of dedicated conspiracists had on the events in Wilmington shows that it took the proper urging and coordination for the coup to unfold and succeed at all. Through comprehensive military planning and the nimble adaptation of rhetoric, Wilmington succeeded where other insurrections failed. I will also argue that the conditions and tactics that allowed Wilmington to succeed can be found in modern acts of political violence, such as the Capitol Insurrection.

85. Aracely Miron-Ocampo

Major: Microbiology, Global Health Studies Certificate

Graduation: Spring 2023

Mentors: Drs. Damian Krysan and Sarah Beattie (Microbiology and Immunology)

Searching for Novel Antifungal Treatments and Regulatory Pathways via the Characterization of a Fluphenazine Derivative Against C. albicans

The *Candida* spp. are commensal yeast, however, under certain host conditions involving immunosuppression, *Candida* can cause life-threatening infections. Previously, the phenothiazine class of drugs including fluphenazine were found to have antifungal activity, however these drugs are associated with unwanted side effects. A structural analog of fluphenazine, (974), was identified as having improved antifungal activity and reduced human receptor binding affinity.

Using drug interaction assays with wildtype *C. albicans*, we observed that subinhibitory concentrations of 974 reduced *C. albicans* susceptibility to fluconazole, an interaction described as antagonism. To understand this antagonistic interaction, we measured the gene expression of the drug efflux pump CDR1, after treating the yeast cells with fluphenazine, 974, or vehicle (DMSO). As previously described, fluphenazine induced CDR1 expression. However, we also observed that 974 induced CDR1 expression to an even greater extent than fluphenazine. To investigate the CDR1 expression we generated mutant strains using CRISPR-Cas9 of the transcription factors TAC1 and MRR2 which are known to regulate the CDR1 pump. Expression of CDR1 in these mutant strains revealed that induction of CDR1 in response to fluphenazine is regulated in part by TAC1 but not by MRR2 while induction by 974 is regulated by both TAC1 and MRR2.

87. Lilian Montilla

Major: Neuroscience

Graduation: Spring 2025

Mentor: Dr. Victoria Muller Ewald (Psychiatry)

Identifying cognitive abnormalities following cerebellar strokes

Although the cerebellum has mainly been implicated in motor function,

recent studies suggest that it is also involved in other higher order processes including memory, timing, affect, and cognition.

The present work was conducted in order to characterize which functions are compromised as a result of cerebellar vascular injury. Seven individuals with cerebellar strokes were given a neuropsychological battery which included the following tests: Stroop color-word, trail making test, and rey auditory verbal learning test.

From all the neuropsychiatric tests assessed, significant impairments were only identified in the Stroop task, a measure of executive function. Results suggest that performance was significantly ameliorated in the sub-section of this task which measures interference (color-word). Upon closer inspection, data suggest that this result stems from a decrease in reading ability of affected individuals. These deficits suggest cerebellar involvement in reading, which is in line with larger literature indicating cerebellar involvement in voluntary control of saccadic eye movement and cerebellar abnormalities in individuals with dyslexia.

These findings further support the theory that the cerebellum plays a significant role in modulating domains beyond the motor. These results are important as they provide the scientific community with a better understanding of deficits linked to cerebellar damage.

89. Joanna Moody

Majors: Public Health, Microbiology

Graduation: Fall 2023

Mentors: Drs. Kelsey Dawes and Robert Philibert (Psychiatry)

Rapid Methylation-Sensitive Digital PCR Assessments Predict Alcohol Withdrawal Syndrome

Excessive alcohol consumption is the third leading preventable cause of morbidity and mortality in the United States. Of the estimated 3 million intoxicated patients admitted into an inpatient hospital setting each year, less than 8% develop signs and symptoms of alcohol withdrawal syndrome (AWS). Despite the identification of several risk factors that associate with AWS, a robust biosignature that could be used to accurately identify and triage those at the highest risk has not been developed. In prior work, we have shown that a battery of 4 methylation-sensitive digital PCR (MSdPCR) assays can sensitively detect heavy alcohol consumption in adults better than carbohydrate-deficient transferrin, with methylation reversion seen with treatment enforced abstinence. Based on the premise that long-term heavy alcohol use is the biggest risk factor for AWS, we determined whether DNA methylation at these four loci predicts the likelihood of AWS better than a commonly used clinical metric, Prediction of Alcohol Withdrawal Scale (PAWSS), in 60 patients admitted to UIHC for alcohol intoxication and placed on alcohol withdrawal protocols. Using a linear regression approach, we found that MSdPCR values, but not PAWSS scores, were significantly associated with total benzodiazepine dosage ($p < 0.001$), a pharmacological treatment for AWS. We conclude that an MSdPCR screening approach could inform clinical decision making for more effective AWS risk assessments. Future studies further refining the prediction parameters are needed to assess the feasibility for translation and clinical utility.

93. Ana Novella Maciel; Benjamin Kreitlow

Major: Neuroscience; MSTP

Graduation: Visiting Scholar; Fall 2024

Mentor: Dr. Gordon Buchanan (Neurology)

Circadian modulation of seizure-associated death in the Scn1aR1407X/+ mouse model of Dravet Syndrome

Epilepsy is a common neurological disease characterized by spontaneous seizures. Sudden unexpected death in epilepsy (SUDEP) is the leading cause of death in patients with medically refractory epilepsy. This is especially true in Dravet Syndrome (DS), a genetic type of epilepsy caused by a mutation in the Scn1a gene, which encodes the voltage gated sodium channel NaV1.1. Seizure-associated death is influenced by the time of day, with death occurring mostly during the night in both patients with epilepsy and in multiple mouse models. One of these models, the Scn1aR1407X/+ mouse model of DS, is susceptible to heat-induced seizures and experiences spontaneous seizures that are sometimes fatal. Spontaneous seizure-associated death has been shown to occur more likely during the night in this model, suggesting a circadian influence. In mammals, the hypothalamic suprachiasmatic nucleus (SCN) regulates the endogenous circadian rhythm. In this project, we will lesion the SCN to eliminate the circadian rhythm and then induce seizures at different times of the day. Our hypothesis is that elimination of the circadian rhythm through SCN lesion will eliminate the nighttime prevalence of seizure-associated death. This work is on-going and will help us better understand how time of day influences the timing of SUDEP.

95. Dean Omar

Major: Human Physiology

Graduation: Spring 2025

Mentor: Dr. Dao-Fu Dai (Pathology)

Renal Dysfunction Caused by Multiple Myeloma in Mouse Model

Multiple Myeloma (MM) is a disease in which plasma cells in the bone marrow become cancerous and multiply. One of the notable effects of MM is renal impairment. Some drugs used to treat MM cause further renal dysfunction. Our hypothesis is that since ER (Endoplasmic Reticulum) stress is a good indicator for renal impairment, then using drugs to treat the MM that also decrease ER stress should limit renal impairment. To prove this, we used Interleukin-6 (IL6)/cMYC (TV2) transgenic mice to create a model for MM. Mice were then divided into different treatment groups; A) Cyclophosphamide + TUDCA. B) TUDCA. C) Cyclophosphamide. D) Cyclophosphamide + Bortezomib. E) ATF4 shRNA Lentivirus. The results from PAS staining have shown that Bortezomib showed increased renal dysfunction, while the Cyclophosphamide + Tudca group showed no notable regression, indicating that the treatment did not have the same negative effect on the kidneys that the Bortezomib had. Moving forward we would also like to add an ATF4 shRNA Lentivirus + Cyclophosphamide group and identify

the group that best treats the MM while limiting renal damage. Another goal would be to identify the pathway that allows Bortezomib to have such a negative effect on renal dysfunction.

97. Precious Pate

Major: Public Health, Pre-Medicine

Graduation: Spring 2024

Mentor: Dr. Maurine Neiman (Biology)

Apple Snails as Model for Gene Modification

I was tasked with maintaining Ampullariidae (apple snails), an invasive species. Apple snails are native to southeast Asia and have been known to disrupt rice fields with their ability to carry parasites. The apple snails were introduced to the lab for their oviparous nature (the ability to lay eggs that hatch externally); this was in contrast to the nature of the ovoviviparous *Potamopyrgus antipodarum* (potamos), (the ability to produce eggs that hatch internally). I've been focused on enhancing the reproductive conditions of the apple snails. Once eggs are hatched, I'll be able to extract their DNA and begin the process of gene editing. The apple snails would serve as a reliable model of mollusks with my transferable methods. Our lab goal is to use these genes to examine questions regarding evolution and complex traits, for the ability to manipulate the genes of the apple snails, can answer foundational questions regarding the topic of complex traits.

99. Mackenzie Patridge

Major: Public Health, Pre-PA

Graduation: Spring 2023

Mentor: Dr. Hans-Joachim Lehmler (Occupational and Environmental Health)

Establishment of pure primary rat astrocyte cultures to study the metabolism and toxicity of polychlorinated biphenyls (PCBs)

Inhalation of indoor air, specifically school air, contaminated with airborne polychlorinated biphenyls (PCBs) represents a major public health concern. PCBs are environmentally relevant developmental neurotoxicants. Many xenobiotic metabolizing enzymes are expressed in the brain, including astrocytes. Metabolism of PCBs can generate products that are also toxic. However, PCB metabolism and toxicity have not been investigated using pure astrocyte cultures. To test the hypothesis that astrocytes metabolize PCBs to create neurotoxic metabolites, a purified culture of primary astrocytes was developed and confirmed through flow cytometry. Primary glial cells were isolated separately from postnatal day 2 rat pups to isolate developing astrocytes. When flasks reached confluency, cells were passaged and reseeded with 2×10^5 cells per flask. Once the cells reached passage 3, flow cytometry was performed utilizing Anti-Iba1 and GFAP primary antibodies. Astrocyte cultures grew at the same rate and became confluent at the same time. Flow cytometry showed that these methods eliminated microglia from the primary cultures. By passage 3, the primary glial cultures became 100% astrocytes. The modified isolation protocol yielded highly pure primary

astrocyte cultures from rats. These cultures will be used in future studies to determine how astrocytes metabolize PCBs and contribute to the developmental neurotoxicity of PCBs.

101. Melissa Peters

Majors: Physics, Math

Graduation: Spring 2023

Mentor: Dr. Jasper Halekas (Physics and Astronomy)

Examining Electrostatic Waves at Harmonics of the Electron Cyclotron Frequency at the Moon

The two THEMIS-ARTEMIS probes have provided a wealth of data on the plasma environment of the Moon, with temporal coverage extending from 2011 to the present. The Moon interacts with plasma in the solar wind and terrestrial magnetosphere, acting as a sink for ambient plasma, as well as a source of charged particles through processes such as photoemission and secondary emission. These interactions simulate a wide variety of plasma instabilities around the Moon, which result in electromagnetic and electrostatic signatures across a broad range of frequencies. One commonly observed signature consists of electrostatic waves with emission at harmonics of the electron cyclotron frequency. These waves are observed most frequently in the terrestrial magnetotail lobes and in the shadow of the Moon but can also occur in other locations. We survey ARTEMIS data from the entire mission to determine when and where these waves occur. We analyze the locations of the probes with respect to the Moon and the Earth when they detect these waves, as well as the local plasma properties, in order to search for correlations that would provide possible explanations for the causes of these phenomena.

103. John Piaszynski

Majors: Statistics, Computer Science

Graduation: Spring 2023

Mentor: Dr. Kanchna Ramchandran (Internal Medicine)

Lesion Network Mapping: A Novel Approach to Brain Lesion Research

This study incorporates an emerging method of lesion analysis known as "lesion network mapping" (LNM) to explore functional neurological networks that are potentially implicated in temporal and probability discounting. Lesion network mapping combines both anatomical lesion maps and functional connectivity data. Rather than performing analysis at the level of individual lesions as existing methods do, LNM considers each lesion as part of a network, which becomes the new unit of analysis. First, binary lesion masks are used as seed regions in a normative connectome to produce correlations between the average BOLD signal in the affected area with each voxel in the functional scan. This is repeated for every image in the connectome, with the results being combined to produce a lesion network for each subject in the lesion dataset. This data becomes the input to voxel-wise general linear

models with discounting score as the response variable, with permutation testing used to determine significance of results. This approach overcomes some of the limitations of lesion-based research: it allows information to be obtained for areas in which there is no lesion overlap in the dataset, and conclusions can be more readily drawn about networks rather than individual regions. As part of an ongoing study, our lab is using LNM to explore the relationship between extreme discounting scores and anatomical networks in the brain.

105. Joseph Schopen

Majors: Physics, Astronomy

Graduation: Spring 2024

Mentor: Dr. Ravitej Uppu (Physics)

Entangled Photon Sources in the Infrared

Spontaneous Parametric Down Conversion (SPDC) is a nonlinear optical process that enables the generation of entangled photon pairs. I built a versatile photon source that can be operated to either generate two telecom band photons for implementing quantum communication or can generate frequency-entangled photons in the mid-infrared (2200 nm - 3500 nm) for applications in quantum-enhanced spectroscopy. Here, I report the spectral measurements of the emitted photons as well as the second-order correlation measurements that quantifies the pair generation efficiency. We demonstrate generation of >3 million pairs/sec (~ 1 pW) highlighting the brightness of our source. The immediate application of the source is towards demonstration high-rate quantum communication over multimode fibers.

107. Darrell Smith

Majors: Chemical Engineering, Biochemistry

Graduation: Spring 2023

Mentor: Dr. Joe Gomes (Chemical and Biochemical Engineering)

Prediction of the HOMO-LUMO gap of organic molecules with graph neural networks

Density functional theory (DFT) is a popular tool for the first-principles study of molecules and materials and the prediction of properties that arise from molecule electronic structure. However, DFT is computationally expensive, and property predictions can take several hours for a modest-sized molecule. Machine learning (ML) poses an attractive alternative which can yield property predictions with high accuracy in a fraction of the time (<1 ms). The high computational efficiency of ML potentially allows for high-throughput development of new catalysts, organic photovoltaic devices, and novel therapeutics.

In this work, we examined the effectiveness of ML for predicting the HOMO-LUMO band gap energy, a task which has previously been identified as being of particular importance due to its relevance in properties including reactivity, photoexcitation, and charge transport. We studied two methodologies for molecule representation as inputs to our learning model. In the first, molecules are represented as two-

dimensional graphs where atoms are graph nodes and bonds are graph edges. In the second, we generate a representative 3-dimensional conformation of the molecule and augment the graph with atom positions and relative distances. We trained and tested both models using the PCQM4Mv2 dataset, a collection of data for over 3.7 million compounds published as part of the Open Graph Benchmark (OGB) Large Scale Challenge (LSC), an open competition for the fair benchmarking of graph

109. Deven Strief

Major: Biomedical Sciences

Graduation: Fall 2025

Mentor: Dr. Michael Dailey (Biology)

Optimizing Immunofluorescence Staining of Microglia in Thick Human Brain Tissues

Staining of brain tissues with fluorescently tagged antibodies provides a powerful approach to examine the cellular and molecular organization of brain tissue structure. We are particularly interested in assessing the structure and functional roles of microglia, the primary immune effector cell of the brain, under pathological states including neurodegenerative diseases. Imaging in thick tissue sections allows for 3D analysis of the cellular structure and cell-cell interactions. However, in human brain tissues, background autofluorescence can present problems with detecting weak signals, creating false positives, and hindering image analysis. Sources of autofluorescence include chemical fixatives, endogenous blood components, and lysosome-associated lipofuscin that accumulates in aging neurons. Various methods to reduce background autofluorescence such as quenching are unfeasible in thick tissue sections. We found that photobleaching tissue sections using an inexpensive, commercially available light-emitting diode (LED) panel prior to immunostaining significantly reduced background autofluorescence for both confocal and multiphoton fluorescence imaging without sacrificing the integrity of the immunostaining. Incorporating twenty-four hours of photobleaching before immunostaining significantly decreased the mean autofluorescence intensity of the tissue sections and increased the signal-to-background ratio, making image analysis possible in thick human tissues.

111. Zach Vig

Majors: Physics, Geology

Graduation: Fall 2022

Mentor: Dr. Emily Finzel (Earth and Environmental Sciences)

Quantifying geochemical provenance of the beaverhead group in southwestern montana using unsupervised machine learning on a sparse dataset

A solid understanding of both the depositional age and provenance of the Late Cretaceous-Early Cenozoic Beaverhead Group is vital in analyzing the nature and timing of flat-slab subduction during the Laramide orogeny. This study aims to use whole rock geochemical signatures to connect Paleozoic carbonate source rocks to those of the carbonate conglomerate clasts from

the Beaverhead Group. By using unsupervised machine learning, we hope to develop new methods for geochemical provenance analysis on carbonates, better constrain the provenance and transport pathways for the Beaverhead Group and, finally, characterize the extensive shallow marine carbonates that exist in much of Southwestern Montana. Preliminary results have shown that source rock carbonates are able to be distinguished in a geologically meaningful way and that their connection to the provenance of the Beaverhead Group mostly supports previous geological interpretations.

113. Gracie Weeks

Major: Human Physiology

Graduation: Spring 2024

Mentors: Drs. Kelsey Dawes and Robert Philibert (Psychiatry)

Cardiometabolic Confounding on cg19693031 Methylation Limits Utility for Diabetes Medicine

Sustained hyperglycemia has been shown to have a significant dose-dependent demethylation effect on cg19693031, suggesting that methylation may be used as a biomarker for T2D. However, our prior findings suggest that the predictive value of cg19693031 is too small to justify clinical translation. Based on the premise that metabolic syndrome and T2D share an overlap in etiology, we assessed whether accounting for cardiometabolic confounding on cg19693031 methylation predicts T2D better than methylation status alone in an African American cohort (N = 460). Using stepwise regression, we show that the methylation of cg19693031 is influenced by HbA1c, systolic blood pressure, HDL and LDL ($R^2 = 0.205$, $p < 2.2e-16$) and that a model which accounts for this confounding explains HbA1c variability better than methylation status alone ($R^2 = 0.2372$, $p < 2.2e-16$ vs $R^2 = 0.1667$, $p < 2.2e-16$) (ANOVA: $p = 1.27e05$). Using a repeated stratified k-fold cross-validation approach, a series of balanced random forest classifiers with random undersampling were built to determine if correcting for cardiometabolic confounding improves the predictive ability of cg19693031 models to discriminate between normoglycemic controls and T2D subjects. The adjusted model performed better than the base methylation model alone with an aggregated ROC AUC of 0.748 vs 0.683, respectively. We conclude that the methylation status of cg19693031 is influenced independently and in combination with HbA1c and cardiometabolic traits and demonstrate that the lack of specificity to T2D limits the utility of cg19693031 for diabetes medicine. Further research is needed to refine the demethylation response of cg19693031 in those with and without disease.

115. Natalia Weinzierl

Major: Human Physiology

Graduation: Spring 2023

Mentor: Dr. Erin Talbert (Health and Human Physiology)

Modeling Cancer Cachexia in KPP Mice

Cancer cachexia, a condition resulting in muscle and adipose tissue wasting,

reduces the outcome of many cancer patients. Cachexia is highly prevalent in pancreatic ductal adenocarcinoma (PDAC) patients, but current murine models have been insufficient in determining effective treatments to treat human cancer cachexia. A recently developed mouse model, Kras(LSL-G12D) Ptf1a(Cre-ER/+) Pten(flox/flox) (KPP), has more closely resembled the development of cancer cachexia in humans. It has been demonstrated that tumors develop in KPP mice at 4 weeks of age; however, body weight discrepancies may be due to delayed growth of mice. To prevent this, pancreatic tumors were induced to develop in KPP mice between 9-10 weeks of age. We found that these KPP mice age had lower body, muscle, and adipose tissue weight compared to non-tumor mice. Body weight was 30% lower, and white and brown adipose tissue mass were 91% and 63% lower, respectively. All analyzed muscles (quadriceps, gastrocnemius, EDL, TA) except the soleus were significantly smaller in mass. Overall, the KPP mouse model can be used to model cancer cachexia in young but fully grown mice. With this data, cancer cachexia can be more effectively modeled in search of an effective treatment.

117. Kaylee Weaver

Major: Human Physiology

Graduation: Spring 2023

Mentor: Dr. Serena Banu Gumusoglu (Obstetrics and Gynecology)

Psychiatric and Obstetric Disease Share Vascular Mechanisms in the RGS2 Knockout Mouse

119. Alexander Williams

Major: Nursing

Graduation: Spring 2023

Mentors: Drs. Ruth Grossmann and Clarissa Shaw (Nursing)

The Relationship Between Rejection of Care, Pain, and Delirium in Hospitalized Patients with Dementia

Dementia is a neurodegenerative disease that can impact memory, cognition, and behavior. Persons living with dementia (PLWD) often exhibit rejection of care (RoC), a behavior that complicates nursing care. The RTC-DAT assessment tool was designed to measure RoC in PLWD (Mahoney et al., 1998). Most research on RoC has taken place in the long-term care setting rather than hospital settings. However, PLWD are twice as likely to be hospitalized compared to older adults without dementia, and while hospitalized experience more complications, longer lengths of stay, and higher costs (Alzheimer's Association, 2018; Bail et al., 2015). As the population of PLWD continues to grow, it is important that hospital dementia care remains a research priority. This project will evaluate the relationship between RoC measured by the RTC-DAT tool and pain and delirium severity in hospitalized PLWD. The PAINAD, CAM-S, and DOSS assessment tools will be evaluated to explore these relationships.

121. Aasthika Das

Majors: Biology, Chemistry

Graduation: Spring 2023

Mentor: Dr. Bhagirath Chaurasia (Internal Medicine)

Inhibition of FGF13 in adipose tissue increases caveolae density

Evidence suggests that a certain lipid class called ceramides are induced in conditions of inflammation and obesity and contribute to metabolic impairments. We found that ceramides act as signals of excessive nutrients altering the metabolic activity of mature adipocytes and consequently, the whole organism. Fibroblast growth factor, Fgf13, was identified, through unbiased genomic approaches, as a ceramide effector molecule which contributes to some of the ceramide actions.

Previously, FGF13 was found to interact with cavin-1 (a caveolae associated protein 1, Gene: Ptrf) in the heart where it negatively regulates caveolae biogenesis. Caveolae are detergent-resistant membrane domains which are abundant in adipocytes, and are essential for glucose metabolism, membrane, and lipid trafficking, and protect cells from potential toxicity of fatty acids. We found that obese Fgf13dAdipo and Fgf13idAdipo had increased cavin-1 and caveolin-1 (most abundant caveolin proteins within adipose tissue) expression at the genomic and proteomic levels. Further analysis revealed a selective increase in caveolae density in the white adipose tissue of both mouse types. Additionally, we ascertained if inhibition of Fgf13 modulates glucose metabolism in adipocytes and found that white adipose tissues from Fgf13idAdipo mice showed increases in Akt-phosphorylation. Collectively, these results suggest that Fgf13 is a negative regulator of caveolae expression.

123. Bailey Goodman

Major: Public Health, Pre-Medicine

Graduation: Spring 2025

Mentor: Dr. Martha Carvour (Internal Medicine)

Epidemiology of Gestational Diabetes Mellitus Before and During the COVID-19 Pandemic

It has been demonstrated through previous research that prevalence of various diseases increased during the COVID-19 pandemic. One of those diseases is diabetes. Our goal was to see if this pattern extended to gestational diabetes. Through our initial literature review, it became clear that psychiatric disorders were strongly correlated with pregnancies and gestational diabetes during the COVID-19 pandemic. This preliminary study showed the relationship between gestational diabetes and psychiatric disorders, which we wish to investigate further in the future.

5:00 Presenters (Odd-Numbered Posters)

2. Jacob Andrews

Major: Physics

Graduation: Spring 2025

Mentor: Dr. Jane Nachtman (Physics and Astronomy)

DUNE, Deep Learning for Neutrino Physics

The Deep Underground Neutrino Experiment (DUNE) seeks to understand neutrino oscillations by constructing neutrino detectors at Fermilab in Chicago and at SURC in Leads, South Dakota to observe how neutrinos change flavor during their flight. I develop deep learning algorithms to reconstruct the interactions we observe in the detector so that we can get the neutrino count at each detector and observe how the neutrinos changed across their flight.

4. Emily Arndt

Majors: History, English and Creative Writing

Graduation: Spring 2024

Mentor: Dr. Sarah Bond (History)

"There Ain't No Shame in Looking for a Better World": The Evolution of Cultural Influence Behind the Folklore of Robin Hood

The legend of Robin Hood is a beloved and well-known household story in our current society. Many kids grow up with the story of the outlaw who evaded evil princes, rescued fair maidens, and gave all he stole to the poor. But how did that story come to fruition? Where did that story come from? This thesis paper sets out to examine why the legend of Robin Hood became such a common story in both English and American society, dating back to the early Middle Ages all the way into the present. This thesis also intends to shed some light on how this story has shifted over time, depending on the cultural values and societal needs of its consumers. To prove the story's evolution over time, specific attention will be drawn to three examples of Robin Hood as an ever-changing cultural medium: the 1475 medieval manuscript "Robyn Hod and the Shryff off Notyngham", Howard Pyle's 1885 novel "Robin Hood and His Merry Men", and Disney's 1973 film "Robin Hood". To conclude, this study will further analyze how the outlaw character trope found its roots in the American mind and the influences this story has had in modern American media.

6. Roxanna Barbulescu

Major: History and Health and Human Physiology

Graduation: Spring 2023

Mentors: Drs. Elizabeth Heineman and Alyssa Park (History)

"Nobody is Nostalgic for Stalinism, but..." Post-Communist Nostalgia in the Memory of Romanian Immigrants in Iowa

This project explores the memory of the late Romanian communist period (1965-1989) of four Romanian American immigrants living in the Iowa City and Cedar Rapids, Iowa area. Based on four qualitative oral history interviews done during the late summer and fall of 2022 this project found that the phenomenon known as post-communist nostalgia exists in Romanian immigrants to Iowa when their memories are examined. However, as the title suggests, this does not necessarily mean a nostalgia for the communist system itself. Rather, the nostalgia is more for the perceived stability that the communist system had and the long past years of childhood. Through this research and analysis this study seeks to add to the existing conversation that exists around post-communist nostalgia in Romania that has been extensively studied since 1989.

8. Leighton Barnes

Majors: Chemistry, History

Graduation: Spring 2024

Mentors: Drs. Elizabeth Yale and Alyssa Park History (History)

Hysterical Women: The Fight for an Expanded British Franchise at the Turn of the 20th Century

This project argues that social and medical claims of female hysteria, specifically in the United Kingdom at the turn of the 20th century, worked as a way of confining women to the domestic sphere. To explore the social implications of feminine hysteria in this region between the late 19th and early 20th centuries, the medical legitimacy of these claims is analyzed through looking at the texts of various surgeon generals, placing them in conjunction with the rapidly changing world. This world, wrought with previously suppressed groups looking for an expanded franchise, was filled with suppressors who worked toward maintaining established social norms. The group analyzed in this project, women, were most prominently suppressed through the negative rhetorical use of medical terms such as female hysteria in pursuit of maintaining the status quo of the early 1800s. This umbrella term was historically used to describe any and all afflictions of women but morphed into ammunition for medical professionals and the general public alike to contain unruly women. This project contextualizes women's health issues encapsulated by this umbrella term (hysteria) and others with the prevailing thoughts on women's suffrage of the time to argue the above claim.

10. Nicole Boodhoo

Major: Biomedical Sciences

Graduation: Spring 2024

Mentor: Dr. Gordon F. Buchanan Buchanan (Neurology)

Mortality following induced seizures in amygdala kindled mice: investigation of the corticosterone stress pathway

Epilepsy affects 65 million people worldwide. One-third of these patients will not achieve seizure control with medication putting them at high risk of sudden unexpected death in epilepsy (SUDEP). Previously, our lab found that the serotonin (5-HT) 2C receptor agonist, MK-212 increased seizure-associated mortality. We found that this also happened in 5HT2C knockout mice, suggesting an off-target effect of MK-212. Since MK-212 increases corticosterone, the major stress hormone in rodents, and stress is a risk factor for seizures, we aimed to examine a role for the corticosterone pathway in SUDEP pathophysiology. We hypothesize that increased seizure-induced death with MK-212 is due to increased levels of corticosterone, leading to increased seizure severity, and that blocking corticosterone receptors prevents MK-212-induced death. We found ~80% mortality rate in animals that were injected with corticosterone antagonist (100 mg/kg) and MK-212 (30 mg/kg), and this did not support our hypothesis. Next, we wanted to see if we could recapitulate mortality findings from prior experiments of MK-212 (30 mg/kg) with corticosterone (10 mg/kg) and MK-212 (10 mg/kg). We will complete experiments with corticosterone antagonist at a lower dose (70 mg/kg), as this was shown to be more optimal, with MK-212 (30 mg/kg) to analyze mortality.

12. Tom Bruner

Majors: Physics, Philosophy

Graduation: Spring 2023

Mentors: Drs. Jane Nachtman and Yasar Onel (Physics)

Quality Control and Assembly Automation for Upgrades to the CMS Outer Tracker

At the Fermi National Accelerator Laboratory I worked on automation processes and quality control procedures for the assembly of sensor modules going into the upgrade of the CMS Outer Tracker at the Large Hadron Collider at CERN.

14. Nina Carnevale

Major: Biomedical Sciences

Graduation: Spring 2024

Mentor: Dr. Rebecca Dodd (Internal Medicine)

Inhibition of the pentose phosphate pathway in malignant peripheral nerve sheath tumors (MPNSTs)

Malignant Peripheral Nerve Sheath Tumors (MPNSTs) are an aggressive sarcoma arising from the Schwann cells of peripheral nerves. MPNSTs constitute for 5-10% of soft tissue sarcomas and are aggressive and highly resistant to chemoradiation treatment. We are currently exploring the therapeutic targeting of critical metabolic pathways in MPNSTs. Importantly, we have recently discovered a critical role for the Pentose Phosphate Pathway (PPP) in the growth and maintenance of these tumors. The PPP is an important signaling pathway involved in production of cellular anti-oxidants. Our preliminary data shows that blocking the PPP with a pharmacological inhibitor can slow growth of MPNST cells in vitro. Similarly, genetic deletion of glucose-6-phosphate dehydrogenase (G6PD), the rate-limiting and first enzyme of the PPP, also slows cell growth in vitro. However, the necessity of the PPP has not been tested in MPNSTs using in vivo models. This project uses established mouse models to define the role of the PPP in MPNST growth using an inducible knockdown of G6PD. We hypothesize that disruption of the PPP in vivo will slow tumor growth and induce apoptotic death. To test this hypothesis, we engineered a doxycycline-regulated inducible shRNA system to target G6PD activity in MPNST cells. These cells will be implanted into immune-competent mice, and tumor growth will be measured in control vs. G6PD-knockout tumors.

16. Gloria Chang

Major: Psychology

Graduation: Spring 2023

Social and Structural Correlates of Instrumental and Emotional Support Following a Natural Disaster

This project was interested in post-disaster outcomes, specifically social support and mental health symptoms, and how those change and evolve post-disaster. Furthermore, the relationship between racial and ethnic disparities/socioeconomic status and the initial support people received was studied. This study went on to investigate how those effects may subsequently lead to different kinds of starting points of emotional support, instrumental support, and depression. And how that then changes people's trajectories of all three of those variables.

Data was used from a large randomized control trial with about 1400 survivors of the 2017 hurricane outbreak that happened across a variety of different locations. The data consisted of survey questions across four waves of data collection, baseline being when someone started the study, usually within a couple months of the hurricane, then 3 months, 6 months, and then 12 months post-baseline. Systemic racism appears to result in a cascade of negative consequences. There were racial ethnic differences in income, and income was related to number of days without shelter. Both of these variables have significant impacts on where people start out in terms of support they have and depression symptoms they experience.

18. Allison Clark

Major: History

Graduation: Spring 2023

Mentor: Dr. Stephen Warren (History)

Commodifying the Spirit Lake Massacre: Abbie Gardner Sharp and Her Role in the Settler-Centric Memory of the Event

This thesis examines how Abbie Gardner Sharp (1843-1921), a survivor of the 1857 Spirit Lake Massacre in Iowa, fundamentally shaped the narrative of a tragic event in the history of Indigenous-settler relations to highlight the victimhood of white settlers. By analyzing ways the Wahpekute Dakota were victims themselves of dispossession and violence at the hands of the white ruling class, it becomes clear that the massacre occurred following years of buildup. Yet this long history was relatively unknown because Sharp successfully harnessed her victimhood, presented the Indigenous community as villains, and contributed to a distinctly settler-centric memory of the Spirit Lake Massacre. As part of her post-captivity activities, Sharp published her narrative, earned revenue to support herself and her family, gained local, statewide, and national influence, and sustained the memory of the event. This presents a complicated situation, in that, while undeniably a victim, Sharp profited off rhetoric that furthered the villainization of Indigenous people. To accomplish this exploration, the thesis considers Sharp's own narrative, newspapers spanning from the time of the event to present day, Annual Reports of the Commissioner of Indian Affairs, Dakota prisoner of war letters, and various local publications concerning Sharp and the massacre.

20. Aditya Desai

Majors: Physics, Economics

Graduation: Spring 2024

Mentor: Dr. Thomas Folland (Physics and Astronomy)

Characterizing the Optical Properties of Materials for Infrared Nanophotonics

Infrared light can be used to detect chemical compounds, observe the temperature of objects, and even engage in free-space optical communication. A key part of realizing technologies using infrared light is developing accurate models for the optical properties of the materials used. To do so, we can use Fourier-Transform Infrared (FTIR) Spectroscopy, where we quantify the light which is reflected and transmitted at different wavelengths. The measurements of reflectance can yield a variety of information about the optical properties of various materials, such as the concentration of additional impurities within the material and their crystal vibrations. These excitations can be used to excite surface light waves known as surface polaritons, which can pave the way toward designing new sensor technologies. For a variety of conventional materials, these properties have been identified; however, many new and exotic materials, various optical properties remain unknown and must be characterized. To characterize the optical properties of unknown materials, it is necessary to compare

experimental data to data projected by a computer model based on various parameters, such as the thickness of the material, angle of incidence of the light, polarization of the light, and inherent properties of the material. By varying the parameters until the computer model's projection closely matches the experimental data, it is possible to identify what the inherent properties of the material are. In my project I created a fitting algorithm within the model which adjusted the parameters within the model representing the inherent properties of the material until the projection most accurately matched the experimental data, and from that was able to characterize the inherent properties of the material. I validated the process by checking it with conventional materials such as sapphire (Al_2O_3) and silicon, before applying it to modified materials such as doped silicon carbide (SiC-4H) to identify and characterize its unknown properties. Overall, these results can be applied in future research to characterize more difficult and complex materials, such as low symmetry crystals, which are of interest to developing future technologies.

22. William Dong

Major: Biomedical Engineering

Graduation: Spring 2024

Mentor: Dr. Kanchna Ramchandran (Internal Medicine)

Heating and artifact testing of a nitinol breast biopsy clip in a high-resolution magnetic resonance imaging (MRI) environment.

This project tests Ultracor Twirl, a nitinol breast biopsy clip, for safety and imaging quality in a 7 Tesla magnetic resonance (MR) environment at the Magnetic Resonance Research Facility (MRRF) at the University of Iowa. Safety testing is relevant in allowing patients with this specific clip to be scanned in 7 Tesla MR scanners for research purposes. The heating test evaluates the temperature safety by measuring the temperature change of the clip induced by radiofrequency coils relative to its surrounding environment. The artifact test evaluates the image quality of the biopsy clip in the MR environment by generating sets of images and determining the extent of artifacts (misrepresentation of the imaged object) since metallic clips can cause signal loss. The safety tests all indicate that the clip is safe in a 7 Tesla MR environment. The artifact test results are currently being analyzed.

24. Aidan Drozdick

Major: Microbiology

Graduation: Spring 2023

Mentor: Dr. Wendy Maury (Microbiology and Immunology)

Investigation of the Impact of Tim Ubiquitination Site Deletions on Ebolavirus Infection

Members of the TIM family of proteins are important regulators of the human immune system and have been documented to play a key role in mediating adherence and internalization of a number of different enveloped viruses,

such as Ebola virus, Dengue virus and West Nile Virus. One recent study found that ubiquitination of specific amino acids in the cytoplasmic tail of TIM-1 enables/enhances Dengue virus uptake into human cells. Published findings from the Maury lab are potentially in conflict with this finding. We have shown that the presence of TIM-1's cytoplasmic tail is not required for Ebola virus adherence and entry into cells. One possible scenario is that the TIM-1 cytoplasmic is not required for enveloped virus binding and internalization, but when the cytoplasmic tail is present on the protein ubiquitination of these amino acids is required. To investigate this hypothesis, we will generate mutations at those sites in the TIM-1 cytoplasmic tail and evaluate if the mutant TIM-1 proteins impact: 1) virus adherence to cells, 2) virus internalization and 3) virus infection of the cells. This research does not correlate directly to any community but will illuminate aspects of virus-cell interactions that could be possible future targets for antiviral drugs.

26. Carter Dwyer

Major: Microbiology

Graduation: Spring 2023

Mentor: Dr. Mary Wilson (Microbiology and Immunology)

Investigating Viability Assays to Monitor Microbicidal Activity Against Leishmania

Leishmania spp. are obligate intracellular protozoa which cause leishmaniasis, a neglected tropical disease endemic in many lower income countries. Major forms of the disease include cutaneous and visceral leishmaniasis which is fatal. The treatment methods for leishmaniasis are wholly inadequate. With one billion people living in endemic areas, the need for adequate treatment is paramount. With this research, comes the challenge of accurately estimating how much Leishmania is present after drug treatment. The hemocytometer is the current gold standard in Leishmania quantification. While widely accepted, this method is time consuming and prone to human error. We must optimize the quantification of Leishmania to effectively screen drugs for microbicidal activity. In this research, we investigated two different quantification methods. One utilizes the Countess II, an automatic cell counter while using a hemocytometer as a gold standard. The other uses a cell permeable dye called calcein-AM that measures esterase activity, a process which occurs only in living cells. These methods were then used to calculate the IC50s of two common antileishmanial drugs, miltefosine and amphotericin B, against both Leishmania infantum and Leishmania braziliensis. With these studies, we can show whether these quantification methods can be applied to broader Leishmania research.

28. Myles Evangelista

Major: Biomedical Engineering

Graduation: Spring 2023

Mentors: Drs. Kristan Worthington (Biomedical Engineering) and Christopher Sales (Ophthalmology and Visual Sciences)

Sprayable biopolymer improves surgical handling of corneal endothelial cell grafts

The best-in-class treatment for dysfunctional corneal endothelial cells (CECs) is a 5-to-10-micron-thick allograft with inconvenient shape memory that allows it to scroll. To prevent scrolling and improve procedure outcomes, we developed a rapidly, easily applied biodegradable coating using spray deposition and photopolymerization. We found that coating thickness is controllable with spray time and curing time is dependent on wavelength and intensity. Furthermore, we measured the impact of wavelength on CEC viability and determined that UV exposure causes extensive CEC death; visible light does not. Eventually, our technology will increase global availability of this sight-saving surgery by simplifying the procedure.

30. Jordan Ewald

Major: Biomedical Engineering

Graduation: Fall 2022

Mentor: Dr. Melissa Fath (Radiation Oncology)

Novel Lead (203Pb/212Pb) Theranostic Pair Targeting CXCR4 in Small Cell Lung Cancers

Small cell lung cancer (SCLC) is a neuroendocrine carcinoma with a low five-year survival rate that highly expresses CXCR4. The precision targeting of CXCR4 with Peptide Receptor Radionuclide Therapy potentially allows for enhanced detection and treatment of SCLC through 203Pb/212Pb radionuclides for imaging and alpha-emitting therapy.

The use of a CXCR4 targeting peptide with 203Pb (diagnostic) in a xenograft model of SCLC will determine personalized dosimetry; combination of this same peptide with 212Pb (therapeutic) can then successfully treat CXCR4 positive SCLC.

SPECT-CT imaging with 203Pb-Pentixather and subsequent biodistribution were performed using murine models bearing human SCLC xenografts. Dose escalation of the 212Pb-Pentixather radiopeptide was conducted to assess the therapeutic efficacy.

Dosimetry performed with 203Pb-Pentixather detected all xenografts and measured to have absorbed doses that correlated with increasing CXCR4 expression in these SCLC cell lines. Following 203Pb imaging, a biodistribution study of the drug demonstrated the highest uptake in liver and kidneys with minimal retention in the bone marrow. The therapeutic dose was studied and showed a significant increase in survival, a delay in tumor growth, and minimal hematological toxicity compared to the untreated group.

These findings indicate that the theranostic pair of 212Pb/203Pb bound to CXCR4 targeting agent is a compelling in vivo anti-cancer agent and diagnostic tool.

32. Hanlong Fan

Major: Psychology

Graduation: Spring 2023

Mentor: Dr. Leyre Castro (Psychology)

Complex Rule Learning in Pigeons and People

Regularities in everyday life allow both humans and non-humans to generate rules and provide structure to their environment. We recently taught pigeons a complex rule where the response to one feature depended on the other accompanying feature appearing with it, so no single feature could predict the correct response (e.g., AB->1 /BC->2 /CD->1/AD->2). Mastering the task could be done by learning the rule, but also by associating the features with one another, and their combination with the response. Our results showed none of the pigeons had inferred the rule; their responses were formed from feature associative learning. Now, we wanted to see how humans perform on this same task, with the same stimuli and no verbal instructions. We expected people to infer the complex rule, but only one third of them did. Another third defaulted to an associative learning strategy, and the rest responded randomly. Although learning complex rules is clearly within the human capacity, the lack of verbal instruction probably led some participants to use a more basic, pigeon-like strategy. It could be that associative mechanisms are the default strategy for all organisms and that further processing is required for rule-based strategies.

34. Olivia Fortman

Major: Microbiology

Graduation: Spring 2024

Mentor: Dr. Richard Roller (Microbiology and immunology)

Significance of UL51 protein-dynactin interaction

Herpesviruses infect almost all humans and cause diseases that range from mild to lethal severity. Virus disease depends on the function of viral proteins that hijack basic cellular functions. One of these hijacked functions is microtubule motor transport. The human herpes viruses share a set of conserved virus genes including one that encodes a membrane protein called UL51. Herpes simplex virus 1 (HSV-1) UL51 and related proteins in other human herpesviruses bind to the p150glued subunit of dynactin, a 23 subunit protein complex, that is a cofactor for the microtubule motor cytoplasmic dynein within the host cell. Amino acid residues 90-125 of HSV-1 UL51 are necessary and sufficient for this interaction. We hypothesize that the UL51 protein-dynactin interaction is important for viral growth or spread within the host cells. We will mutate specific amino acids in the dynactin interaction sequence of UL51 in the context of an expression plasmid and test for interaction between the mutant UL51 and dynactin. Mutations that disrupt the interaction with dynactin will be introduced into the virus genome and we will then test the effect on viral growth and spread within host cells.

36. Grace Foster

Major: Human Physiology

Graduation: Spring 2023

Mentor: Dr. Gary Pierce (Health and Human Physiology)

Association of resting central pulse-wave analysis hemodynamic parameters with the blood pressure response to exercise

An exaggerated exercise blood pressure (EEBP) is associated with poor cardiovascular outcomes. Pulse-wave analysis (PWA) non-invasively derives central BP waveform hemodynamic parameters that may provide physiological insight into EEBP beyond standard brachial BP measurement. However, whether selected central PWA hemodynamics are associated with BP responses to exercise is unknown, which was the aim of the present study. Participants (n=175, mean age=63±6.24, 61% women) were retrospectively analyzed in healthy adults in whom PWA and maximal exercise testing with maximal oxygen uptake (VO₂max) was performed. PWA hemodynamics were derived from carotid BP waveforms acquired via applanation tonometry and aortic stiffness was measured via carotid-femoral pulse wave velocity (CFPWV). The brachial BP response to exercise was determined during the maximal exercise stress test conducted using a ramp protocol on a stationary bicycle. An EEBP response was defined as SBP ≥210 mmHg in men and ≥190 mmHg in women. A true maximal test was defined as a rating of perceived exertion (RPE) of ≥16 and respiratory exchange ratio (RER) ≥1.0. Resting systolic BP exhibited the strongest association with peak exercise systolic BP. Aortic stiffness and key PWA parameters measured at rest were not associated with an individual's BP response to maximal exercise.

38. Nathan Freesmeier

Major: Biology

Graduation: Spring 2024

Mentor: Dr. Christopher Stipp (Biology)

Targeting cell adhesion to overcome drug resistant melanoma

Melanoma is the deadliest form of skin cancer, with an estimated 90,000 new cases of invasive disease and 10,000 deaths per year. In ~40% of melanoma cases, the cancer initiating event is a mutation in the BRAF gene, which encodes a protein that promotes cell proliferation. These BRAF-mutant melanomas typically respond to orally administered BRAF inhibitors that block the activity of mutant BRAF. Unfortunately, melanoma cells often develop resistance to such BRAF-targeted therapies and regain the ability to proliferate. There are multiple pathways by which drug resistant melanomas can emerge, and some of these pathways may involve increased adhesion of melanoma cells to the extracellular matrix on which the cells are growing. Other pathways to resistance can involve additional mutations in the BRAF gene that block the binding of BRAF inhibitors. We hypothesized that drug resistant melanoma cells that rely on cell adhesion would be selectively sensitive to inhibitors of focal adhesion kinase (FAK), which can promote cell proliferation when it is activated downstream of cell adhesion. Surprisingly, we

found that both classes of drug-resistant melanoma cells responded to FAK inhibitors, suggesting that targeting cell adhesion in melanoma may be more broadly applicable than anticipated.

40. Maunika Gandhamaneni

Major: Chemical Engineering

Graduation: Spring 2023

Mentor: Dr. Daniel Weeks (Biochemistry and Molecular Biology)

Features of Proteins That Allow Them to Form Nucleolar Compartments.

The nucleolus is an organelle which is responsible for ribosome biogenesis. Hundreds of proteins are involved in the process of ribosome biogenesis, and many of the proteins are concentrated by phase separation in the nucleolus. The nucleolus has three distinct compartments thought to be formed through phase separation, each with a specific role in ribosome biogenesis. The compartments include the fibrillar center (FC), dense fibrillar component (DFC), and the granular component (GC) which are responsible for rRNA synthesis, rRNA modification, and ribosome assembly respectively. We want to understand why proteins phase separate into certain compartments over another. To learn more about this phenomenon, we tested two hypotheses regarding nucleolar protein compartmentalization using *Xenopus laevis* oocytes. The first is that intrinsically disordered domains found in nucleolar proteins are sufficient to direct nucleolar domain compartmentalization. The second is that for some proteins, compartmentalization depends upon stable binding to multi-protein nucleolar complexes.

42. Brandon Gerhardt

Major: Public Health

Graduation: Fall 2022

Mentor: Dr. Hari Sharma (Health Management and Policy)

Profit Status and Quality Assurance Assessment Fees in Iowa Nursing Facilities

Quality Assurance Assessment Fees (QAAF) are a way for nursing facilities in Iowa to receive additional funding. Facilities receive a fixed amount of money for every Medicaid patient they have, and pay back a fixed fee for every non-Medicare patient. A majority of facilities end up with excess received payments. A majority of this funding must be spent on enriching nursing facility workers. Most often, this takes the form of wage increases. If a facility does not receive more than they pay, then they are exempt from the investment requirements. We used descriptive analysis and multiple linear regressions to assess whether profit status is associated with the amount of QAAF fees invested on workers. There was no significant difference in the receipt of excess payments by profit status. Controlling for facility size, year, exemption status, CCRC status, adjusted nurse hours per resident per day, overall facility rating, and if the facility was fined, we found that nonprofit

facilities invested more in their workers than for-profit facilities.

44. Nicole Gilbert

Majors: History, Psychology

Graduation: May 2023

Mentor: Drs. Alyssa Park and Tyler Priest (History)

Fame and Femininity: First Lady Jacqueline Kennedy's Public Diplomacy during the Cold War

This thesis explores First Lady Jacqueline Kennedy and her impact on public and cultural diplomacy from 1961-1963 during the Cold War. It illuminates her role in politics, departing from previous scholarship which has focused primarily on her role as mother, wife, fashion icon, and hostess of elaborate state dinners. The paper shows Jacqueline Kennedy's significance in the sphere of foreign diplomacy has been largely neglected by scholars who prefer to box her in as an admirable hostess and nothing more. Kennedy was, in fact, an effective diplomat for the Kennedy administration by charming Soviet Premier Nikita Khrushchev and uplifting important alliances with nations like France. Using memoirs, government and personal documents, newspapers, etc., the paper examines her use of cultural diplomacy, soft power, and fashion diplomacy to advance U.S. foreign policy during the Cold War. American foreign policy during the Kennedy administration centered on containment to prevent the spread of communism. The U.S. also wanted to advocate for American democracy in recently decolonized nations. Jacqueline Kennedy was an unexpected, but effective diplomat in a period where soft power was needed to contest the Soviet Union's goal to spread communism. By promoting cultural exchange and subtly promoting American ideological values, the first lady garnered foreign public support and admiration for the U.S. in a critical period.

48. Allison Groux

Major: Health and Human Physiology

Graduation: Fall 2022

Mentor: Dr. Terry Wahls (Internal Medicine, Epidemiology)

Motor Assessment Procedures in the Efficacy of Diet on Quality of Life in Multiple Sclerosis Study

Multiple Sclerosis (MS) is a progressive neuroinflammatory and neurodegenerative disease with an idiopathic etiology believed to have resulted from the complex interactions between genetic, infection, dietary, and other unknown environmental exposures. MS commonly manifests in the forms of pain, fatigue, mood changes, cognitive decline, and vision complications. The clinical study, Efficacy of Diet on Quality of Life in Multiple Sclerosis (EDQ: MS) IRB 202104639, has a primary focus on critically evaluating the effectiveness of incorporating dietary guidance into the treatment plans of those with relapsing remitting multiple sclerosis (RRMS) with the intention of improving long-term quality of life. There is also a

secondary objective to measure the long-term effects on motor function, low-contrast vision sensitivity, fatigue, mood, and disease activity assessed by brain imaging.

The improvement of function and reducing the disability burden among MS patients is urgently needed, and dietary interventions are a promising non-pharmacologic option to maintain health and function among MS patients. In the EDQ: MS study, motor function tests are administered and analyzed at month zero, three, and twenty-four. Participant ability to perform these tasks and the quality in which they are completed correlate to the disease's impact on personal lifestyle such as the capability of retaining work and living independently.

50. Bryan Guevara

Major: Biology

Graduation: Spring 2023

Mentor: Dr. Maurine Neiman (Biology)

Assessing the Effects of Plastics on Sperm Morphology

In humans, male fertility has been on the decline in recent decades. Correspondingly, plastic production and usage has been on the incline as plastics continue to serve as a cheap alternative for mass-producing goods. Plastics are made with plasticizers that contain endocrine-disrupting chemical additives. Many of the goods and services that are involved in our literal ingestion are wrapped, transported, or contained in plastic in some shape or form. These plastics contain chemicals with the potential to disrupt our hormones and are used every day, typically with no concern for human long-term health. Using the New Zealand mud snail, *Potamopyrgus antipodarum*, as a model of ecotoxicology based on previous works, I am working to assess the effects of plastic on sperm morphology as a proxy to humans. The plastic containers the snails will be housed in will be treated to similar conditions that a standard water bottle would go through after having left the factory in which it was made. So the question remains, is this cheap commodity that has improved our lives so much damaging our reproductive and potentially overall health beneath the surface?

52. Mary Haag

Majors: Astronomy, Physics

Graduation: Spring 2025

Mentors: Drs. Jane Nachtman and Yasar Onel (Physics and Astronomy)

Cooling System for CMS Barrel Timing Layer Upgrade

The University of Iowa CMS group is working on the Barrel Timing Layer cooling system in preparation for the LHC Run 4 at CMS. A prototype CO₂ cooling system was developed by Iowa engineers and tested at Fermilab. Simulation studies using the FLUENT software were performed to understand the observed behavior, but limited by input parameter models. The fluid properties were studied to improve the input models for the temperature dependence of the CO₂ viscosity using existing literature. The results of these

studies and future prospects will be discussed.

54. Audrey Hake

Major: Microbiology

Graduation: Spring 2025

Mentor: Dr. Liliana Radoshevich (Microbiology and Immunology)

*Generating a Δ Imo2839 Mutant in *Listeria monocytogenes* Using the pMAD and pHoss Plasmids for Allelic Exchange*

Listeria Monocytogenes is an opportunistic, gram-positive protein found on everyday surfaces and is commonly transmitted through contaminated food, causing an illness known as Listeriosis. Listeriosis is rare, but primarily affect immunocompromised individuals, pregnant women, infants, and the elderly. In the lab, we are examining *Listeria* protein Imo2839 and its overall effect on the virulence of *L. monocytogenes*. To do this, we have been working towards generating a Imo2839 knock-out mutant using various methods with two different plasmids; pMAD and pHoss. Following the creation of the mutant, we plan to study the virulence of the mutant compared to a wild type strain of *L. monocytogenes* by infecting eukaryotic cells in a lab environment.

56. Izabella Halinowski

Major: Biochemistry

Graduation: Spring 2024

Mentor: Dr. Pamela Geyer (Biochemistry & Molecular Biology)

Investigating the role of Checkpoint kinase 2 in gamete quality control

The germline is central to species propagation. Gamete development is under strict regulation to ensure production of high-quality oocytes and sperm, and healthy offspring. To understand processes involved in quality control, we study the *Drosophila* ovary, a well development model of germline stem cells (GSCs) and oocyte development. Our previous studies showed that GSC maintenance requires nuclear lamina proteins, as mutations in genes encoding emerin and BAF cause GSC death. Loss of GSCs in these mutants results from non-canonical activation of Checkpoint Kinase 2 (Chk2), a kinase in the DNA damage response. We are interested in understanding more about the role of Chk2 in GSC survival. To this end, we are developing reagents to follow activated Chk2. Activation of Chk2 involves phosphorylation of two threonine residues in an activation loop of the kinase domain. We have developed antibodies against a di-phosphorylated activation loop peptide and are testing the ability of these antibodies to recognize phosphorylated Chk2. Once antibodies are validated, these antibodies will be used to advance our understanding of pathways leading to Chk2 activation and mechanisms of oocyte quality control.

58. Daniel Hettrick

Majors: History, Anthropology

Graduation: Fall 2022

Mentors: Drs. Alyssa Park and Stephen Warren (History)

Forced Acculturation and Resistance in Post-Purchase Alaska

My thesis examines how the Tlingit people of Southeast Alaska resisted forced acculturation through the banning of the Potlatch and the Tlingit language by the American Presbyterian mission led by Reverend Sheldon Jackson from 1870 to 1917. Prior to the purchase of Alaska from Russia by the United States in 1866, the Russian state attempted to convert many of the Tlingit to Russian Orthodoxy. Russia's policy failed to yield many converts due to a series of historical conflicts between the two peoples. The purchase of Alaska led the Presbyterian and Orthodox Churches into a competition over the religious preferences of the Tlingit. The project shows that the Tlingit largely adopted Orthodoxy in 1886 as the Russian Orthodox Church, without the presence of the Russian State, was willing to accommodate Tlingit cultural beliefs so long as they did not contradict Christian doctrine. Using correspondences, journals, local and national newspaper articles, primary monographs, and other primary sources, this project shows that most Tlingit willingly and enthusiastically adopted Russian Orthodoxy as a form of resistance against Presbyterian acculturation.

60. Talia Hill

Majors: Geoscience, History

Graduation: Spring 2023

Mentor: Dr. Ashley Howard (History)

A Regional History of Alabama's Black Belt

This thesis examines African Americans in Alabama's Black Belt—the majority constituent in the region—and their centrality in Republican and Communist Party voter campaigns. The Black Belt, originally named for the geological conditions of the soil, was home to a large slave population from the eighteenth century. As African Americans became the largest settled community across the belt's counties, they were seen as useful constituents, first for Alabama politicians in the early twentieth century and, second, for the Communist Party of New York in the 1930s. Both hoped to mobilize the African American vote to bolster support for their own parties. Through analyzing letters from Joseph C. Manning in the early twentieth century, it is shown that the Republican Party wished to mobilize the African American vote to win seats in government. Two decades later, The Southern Worker newspaper publications follow the rise of communism in the Black Belt and demonstrate how outside forces wanted to utilize the area to spread communism. These instances reflect a growing trend over time for the disregard of appreciating the individuals in the Black Belt as independently conscious of politics. This thesis shows that African Americans would work within these parties to advocate for their needs, but this advocacy by African Americans is often overlooked when understanding a regional history of the area.

62. Ashley Hoffa

Major: Speech and Hearing Sciences

Graduation: Spring 2025

Mentor: Dr. Eun Kyung Jeon (Communication Sciences and Disorders)

Adult Eustachian Tube Dysfunction: A case study

Have you ever experienced discomfort in your ears when flying? This discomfort gets worse and may stay for days when the eustachian tube (ET) does not work appropriately. The ET is a narrow tube that links the middle ear to the nasopharynx, allowing pressure to be relieved and fluid to be cleared from the middle ear cavity. Eustachian tube dysfunction (ETD) is very common in children. Research shows that about 40% of children develop at least transient ETD, and the maturation of the ET facilitates appropriate functioning. About 1% of adults with ETD continue to have difficulty relieving pressure and fluid, resulting in mild to severe hearing loss. Unfortunately, due to a lack of awareness in mainstream medicine, the pains and hearing loss of the adults with ETD are overlooked. One of the authors has ETD suffering from adolescence to adulthood. The purpose of this study was two-fold: one to review current diagnosis and treatment of ETD, and another to present a case study of adult ETD reviewing for progression of symptoms and treatments since adolescence. Most of all, we hope this study will bring awareness to improve healthcare and quality of life for the adult ETD population.

64. Payton Jaeger

Major: Multidisciplinary Sciences

Graduation: Fall 2023

Mentor: Dr. Queena Lin (Iowa Neurobank Core)

Convergency of Spatial Gene Expression between ADHD and Parkinson's Disease

I am going to test to see if there is correlation between Attention Deficit Hyperactivity Disorder, Lewy Body dementia, and Parkinson's Disease through genetic densities and similar gene expressional patterns. This means that I must have many adequate samples of cases of dementia and ADHD which will be evaluated using MERSCOPE technology, along with needing an in-depth knowledge on all the presented diseases. I will use specific brain regions that are known to be implicated in all these diseases and are available at the Iowa Neurobank Core for running this experiment. Additionally, this experiment will expand upon the neurotransmitter deficits experienced by Lewy Body Dementia, Parkinson's, and attention deficit hyperactivity disorder.

66. Liv Jewell; Bree Rubel

Majors: Gender, Women's, and Sexuality Studies; Gender, Women's, and Sexuality Studies

Graduation: Winter 2023; Spring 2024

Mentor: Dr. Teresa Mangum (Obermann Center for Advanced Studies)

68. Joseph Kesteloot

Major: Microbiology

Graduation: Spring 2023

Mentors: Drs. Lilliana Radoshevich and Aaron Gillman (Microbiology and Immunology)

Using Allelic Exchange to Generate a Nutrient Acquisition Deficient Mutant (lmo2839) in Listeria Monocytogenes

Listeria monocytogenes is a Gram positive, food-borne, pathogen that primarily affects immunocompromised individuals, leading to meningitis in elderly patients and fetal infection or loss in pregnant mothers. Although relatively rare, listeriosis causes about 1600 cases per year in the United States and the mortality rate is 20-30%. *Listeria monocytogenes* crosses the intestinal barrier and spreads to the liver and spleen where it replicates intracellularly in immune cells and hepatocytes. Host cells target intracellular pathogens using a catabolic pathway called xenophagy, which entraps invading bacteria in a double-membraned vesicle which delivers the bacteria to the lysosome. Bacteria and the associated host membranes are targeted for xenophagy by the ubiquitin-proteasome system. Here we mapped ubiquitin-sites following infection with *Listeria monocytogenes* in the liver of infected mice and identified a bacterial lipoprotein as a target of ubiquitin.

Interestingly, the lipoprotein is part of a putative operon with two ABC transporter proteins. Several genome-wide studies determined that the lipoprotein is upregulated following growth in human and mouse blood. This work centers on creating a gene deletion of the lipoprotein using allelic exchange and the plasmid pHoss1 to test whether it contributes to virulence in epithelial cells, macrophages and murine models of infection.

70. Karah Kluck

Major: Speech and Hearing Sciences

Graduation: Fall 2022

Mentor: Dr. Stewart McCauley (Communication Sciences and Disorders)

Experience-based Chunking Shapes Real-Time Reading Ability

Whether and to what extent individual differences in reading ability are shaped by experience as opposed to domain-general mechanisms, such as working memory, remains an object of intense debate. Here, we present a three-experiment study contrasting the role played by experience-based unit formation (i.e., "chunking") with that of working memory ability in supporting complex sentence processing in reading. In Experiment 1, we show that subjects are able to generalize implicit knowledge of consonant clusters from the ambient text environment (e.g., x p l) to a recall task involving strings of 9 consonants (e.g., n r c x p l n t h). In Experiment 2, we show that the same applies to strings of digits (e.g., 8 1 9 1 0 2 9 6 0), with better recall for digit substrings that occur more frequently in text. Finally, we show in Experiment 3 that chunk sensitivity (as reflected by recall advantage for higher-frequency substrings vs. randomly ordered sequences in Experiments 1 and 2) predicts reading times for embedded relative clauses. These results run counter to a

working memory account of individual differences in reading ability, supporting instead the notion of overall reading experience as a primary factor in shaping outcomes.

72. Ben Koester

Majors: Finance, Economics

Graduation: Fall 2022

Mentor: Dr. John Lewis Jr. (Finance)

Why Individual Investors Do Not Use Robo-Advisors

This study investigates consumer opinions on automated financial advising programs, or "robo-advisors". The study utilized a questionnaire to determine why investors do or do not use robo-advisors. We then ask for additional information to find the motivation for people to select robo-advisors. We conducted the study on Reddit.com, an online discussion site which has a population of knowledgeable and active investors. Our research found that the use of robo-advisors is low due to many investors not knowing they exist. Those that do use robo-advisors select them for the convenience or had no other choice. Another finding of our research is that investors who are satisfied with their use of robo-advisors have access to a number of features available from traditional human advisors.

74. Emmeline Kraus

Majors: Environmental Science, Geography

Graduation: Spring 2023

Mentor: Drs. Matthew Dannenberg and Susan Meerdink (Geographical and Sustainability Sciences)

*Seasonal effects of the fungal pathogen *Tubakia iowensis* (bur oak blight) on the photosynthetic capacity of infected *Quercus macrocarpa* (bur oak)*

Bur oak blight, a late-season leaf disease of *Quercus macrocarpa* (bur oak), has increased in prevalence in Iowa, Minnesota, and Nebraska since the 1990s. The disease, caused by the fungus *Tubakia iowensis*, causes vein necrosis and leaf death in afflicted trees. To prevent further spread of bur oak blight and protect native bur oak populations, more research is needed on the progression of the disease, its seasonal physiological effects, and its detection and management. To understand how blight progression influences bur oak photosynthetic capacity, we measured changes in the maximum rate of carboxylation (V_{cmax}) and the maximum rate of electron transport (J_{max}) of 20 mature bur oak trees experiencing *Tubakia* infections of varying severity for 10 weeks (June 1 - August 5, 2022). We assessed the physiological effects of blight using mixed-effects models. Future research is needed to: 1) determine the relevance of the length of time a tree has been infected on the physiological impact of blight, 2) assess the feasibility of early detection of infection (which normally does not manifest visually until mid-to-late July), and 3) understand the influence of management of the disease's effects on plant physiology.

76. Connor Linzer

Major: Human Physiology

Graduation: Spring 2024

Mentors: Drs. Jared McLendon and Ryan Boudreau (Internal Medicine)

Sorbs2 regulates smooth muscle phenotype plasticity

Cardiovascular disease continues to be a leading cause of death within the US, and treatments are often ineffective. Previously, we identified that Sorbs2 is expressed in coronary vascular smooth muscle cells and may contribute to cardiovascular disease. Sorbs2 is a cytoskeletal adapter protein, however the role of Sorbs2 in vascular smooth muscle cell (VSMC) has not been characterized. We hypothesize that Sorbs2 integrates in focal adhesion networks to regulate VSMC mechanotransduction and direct contraction, proliferation, and migration phenotypes. Immunofluorescence experiments show that Sorbs2 is localized along actin fibers, at lamellipodia, and appears to congregate at cell:matrix junctions. We mechanically stretched cells and showed that Sorbs2 RNA and protein expression decreased. Our molecular cloning techniques have identified six uncharacterized Sorbs2 transcript isoforms in VSMC. Overexpression of Sorbs2 isoforms in VSMC cultures reveal distinct proteins via western blot that are differentially located based on immunofluorescence staining. We also assayed PDGF stimulated proliferation in VSMC cultures after knockout of Sorbs2, and proliferation increased. Our results suggest that VSMC Sorbs2 expression is regulated by mechanical stretch, integrates with actin and adhesion networks, and contributes to smooth muscle cell plasticity. Future work will explore the functions of Sorbs2 isoforms in the progression of vascular disease.

78. Kobie Long

Majors: Environmental Science

Graduation: Spring 2024

Mentor: Dr. Benjamin Swanson (Earth and Environmental Sciences)

Identifying Areas of Groundwater-Surface Water Exchange along Camp Cardinal Creek at Ashton Prairie Living Laboratory

Groundwater-Surface water interactions are an important component of aquatic ecosystems. Groundwater provides temperature refugia and nutrients to stream systems. I aimed to locate areas where groundwater is entering Camp Cardinal Creek in order to inform future aquatic habitat and groundwater studies, including ongoing, repeated aquatic macroinvertebrate surveys. I measured water temperatures every 3-5m with a digital thermometer set approximately 2 cm above the streambed. The thermometer was attached to a GPS survey rod, and the GPS was used to locate each measurement point along a longitudinal profile of the stream channel. The macroinvertebrate surveys were conducted twice at six different sites, along 50m stream reaches for 1 hour. The temperature survey identified three reaches of the stream that are strongly influenced by incoming groundwater, and initial macroinvertebrate sampling indicate these areas also harbor macroinvertebrates which are indicative of relatively good water quality.

Future work will compare water quality sampling results to an IBI index which will be calculated using the macroinvertebrates survey data. Additionally, work in the future will include identifying groundwater input locations and volumes with more detailed analysis.

80. Madalyn Lovejoy

Majors: Psychology, Gender, Women's, and Sexuality Studies

Graduation: Spring 2024

Mentor: Dr. Teresa Treat (Psychological and Brain Sciences)

Rape-Supportive and Sociosexual Attitudes among Heterosexual, Bisexual, Asexual and Gay College Men

Sexual assault is a serious issue on college campuses, and individuals who identify as a gender or sexual minority experience significantly higher rates of sexual violence compared to heterosexuals. Theoretical models of sexual assault implicate two attitudinal variables in the perpetration of sexual assault: endorsement of rape-supportive attitudes (RSA) and sociosexuality (a preference for casual or impersonal sex). Most existing literature has focused on heteronormative views of RSA, in which men are perpetrators and women are victims. Further, most empirical research has studied primarily heterosexuals' sexual attitudes. The current study characterized sexual attitudes in a large sample of college men (n = 1315, aged 18-24) as a function of sexual orientation (asexual, bisexual, gay, heterosexual). Results for RSA showed that asexual men endorsed more RSA than heterosexual men, who endorsed more RSA than bisexual and gay men. Results for sociosexuality showed that gay and bisexual men endorsed more sociosexual attitudes than heterosexual men. Ultimately, improving our knowledge of college men's sexual attitudes as a function of sexual orientation may better position us to educate sexually diverse students about sexual violence on college campuses.

82. Hailey McCoy-Munger

Major: Biomedical Engineering

Graduation: Spring 2024

Mentor: Dr. Lori Wallrath (Biochemistry and Molecular Biology)

Identification of potential treatments for the vision disease Retinitis Pigmentosa

Retinitis pigmentosa (RP) is an inherited human vision disease that causes progressive retinal degeneration due to photoreceptor cell death, which can ultimately lead to blindness. Mutations in the gene SNRNP200 cause RP. The SNRNP200 gene encodes a core pre-mRNA splicing factor. Non-genetic factors contribute to disease progression, including oxidative stress and inflammation that have been observed in humans with RP. Therefore, antioxidants and anti-inflammatory agents are potential treatments. Utilizing the model organism *Drosophila melanogaster*—the fruit fly—depletion of fly *Snrnp200* caused cell death in the developing eye and a “rough eye”

phenotype in adults. The rough eye provides an easy visual phenotype to screen for drugs that correct the eye defects. As such, we have treated fruit flies depleted for Snrnp200 with N-acetylcysteine (NAC), a powerful antioxidant, and dimethyl sulfoxide (DMSO), a compound that is used as an alternative treatment for inflammation. We observed a dose-dependent correction of the rough eye phenotype with NAC and DMSO. Consistent with this observation, there was reduced cell death in the developing eye. Thus, our studies support antioxidants and anti-inflammatory drugs as potential treatments for SNRNP200-associated RP.

84. Bob Pentuic

Major: Environmental Policy

Graduation: Spring 2023

Mentor: Dr. Ben Swanson (Earth and Environmental Sciences)

Camp Cardinal Creek Water Quality

For the past 6 months I have been collecting water quality data at Camp Cardinal Creek in Coralville. The university plans to use the area around this creek as a "living laboratory," and the data I've gathered will be referenced by future students learning to do similar research.

On top of this, I have found that the creek is extremely healthy in terms of water quality. I have tested for ammonia, alkalinity, nitrates, phosphates, chloride, iron, temperature, conductivity, dissolved oxygen, pH, and turbidity.

86. Ana Sofia Peraza Muñuzuri

Major: Biomedical Engineering

Graduation: Spring 2023

Mentors: Drs. Joel Geerling and Silvia Gasparini (Neuroscience)

Nucleus of the solitary tract: molecular ontology and efferent projections

The nucleus of the solitary tract (NTS) is a sensory nucleus located in the dorsomedial medulla. The NTS is a major integrative center for autonomic functions and visceral sensations such as digestion, breathing, appetite, taste, blood pressure, and heart rate regulation. Although the NTS is crucial in sustaining everyday autonomic functions, we lack a comprehensive understanding of its neuronal populations and their efferent projections. Here we provide a set of molecular markers which distinguish NTS neurons and map the efferent projections of several NTS neuronal subpopulations.

88. Melissa Peters; Emerson Peters

Majors: Physics, Mathematics; Physics

Graduation: Spring 2023; Spring 2025

Mentor: Dr. David Miles (Physics and Astronomy)

Balloons Learning the Accuracy of Magnetic Field Models (BLAMM)

Earth's magnetic field is essential for human science and activities. Magnetic field models, like the Chaos-7 model, provide field values for each location around the Earth. Model values are used to calibrate scientific sensors and monitor their interactions with Earth's magnetic field. Flights and experiments reference model values to properly shield their instruments from magnetic interactions with Earth. These model values allow for calibration of compasses, GPS, and consumer navigational systems. However, magnetic field models have their downfalls: ground stations and space satellites measure field values and, by interpolating these data points, estimate the field values at each location in between measurements. There are no direct measurements between these areas, and models do not consider local disturbances and anomalies. How accurate are magnetic field models at altitudes where there are no direct measurements? Balloons Learning the Accuracy of Magnetic-field Models (BLAMM) aims to verify estimated values of magnetic field models. BLAMM's goal is to take direct measurements at up to 30 km in altitude to explore if the interpolated values between space and ground are accurate. BLAMM's discoveries will act as a step towards validating model estimates, even with just a single data point from neither ground nor space.

90. Ashley Rhodes

Major: Biomedical Engineering

Graduation: May 2024

Mentors: Emily Witt (Radiation Oncology) and Dr. James Byrne (Radiation Oncology, Biomedical Engineering)

A novel, non-invasive drug delivery device to target bladder cancer

Bladder cancer is one of the most common types of cancer in the US with nearly 80,000 individuals in the US diagnosed annually. The majority of these cases are caught in the early stages where the cancer is contained in the epithelial lining of the bladder. To treat this non-muscle invasive cancer, tumors are removed from the bladder and then the patient undergoes subsequent bladder therapy with immunotherapy or chemotherapy instilled in the bladder. Then UIHC pioneered a unique combination of gemcitabine and docetaxel for treatment of bladder cancer. These drugs are delivered into the bladder at specific time intervals by a trained urologist, and the patient is required to sit in outpatient care for up to 6 hours while the procedure is performed. There currently exists bladder drug delivery devices that aim to reduce the outpatient clinic time, including the TAR-200 (Johnson & Johnson). However, this device still requires delivery and removal by a trained urologist. To overcome these challenges, we have created an intravesical delivery system for docetaxel that can be administered by a Foley catheter and does not require removal. The device is composed of biocompatible, pH sensitive polymers that can be urinated out once the drug has been absorbed by the lining of the bladder. This model allows complete control over shape and drug delivery. The device also has the potential to be used for the treatment of UTIs and other bladder diseases.

92. Katie Rosol

Major: Psychology

Graduation: Spring 2023

Mentor: Dr. Rachel McLaren (Communication Studies)

Discussing Disappointments between Parents and Child Relationships

This project investigates dyadic interaction patterns in parent-adolescent conversations about disappointing events, using confirmation theory and hope theory. The data has already been collected by Professor McLaren and consists of 10-minute video recordings of 94 parent-adolescent dyads discussing a recent disappointment that occurred in their life. Currently, the video recordings are being coded (and will continue to be this summer). The interaction behaviors that are being coded are information giving, information seeking, behavioral coaching by parents, confrontation, contrition, avoidance/withdraw, confirmation, warmth, and involvement. Specifically, we will be using confirmation theory and hope theory to understand how interaction behaviors help adolescents to feel better and more understood after a conversation with their parent about a disappointing event. We are currently doing work about

94. Karsyn Rush

Major: Speech and Hearing Sciences

Graduation: Spring 2023

Mentor: Dr. Inyong Choi (Communication Sciences and Disorders)

Neurofeedback Training

Understanding speech in noise is essential for communications in everyday real world settings. However, persistent variability in speech-in-noise perception exists even in young listeners with normal hearing thresholds. Yet, no therapeutic method has been established for normal-hearing listeners who struggle with speech-in-noise understanding. Conventional hearing remediations through amplification do not always improve speech-in-noise ability. Instead, perceptual training is one of the very few options currently available for such speech-in-noise problems in normal-hearing listeners, although a dearth of information exists regarding its efficacy and mediating biological mechanisms. This project aims to validate the feasibility of a novel auditory training protocol to improve speech-in-noise performance in normal-hearing listeners and investigate what biological changes such a training protocol induces.

96. Yasmina Sahir

Majors: Criminology, Law, and Justice, Social Justice

Graduation: Spring 2023

Mentor: Dr. Yasmine Ramadan (Arab Studies, French and Italian)

Middle Eastern, North African, and Arab Representation at University of Iowa

At University of Iowa, Middle Eastern, North African, and Arab students, their languages, cultures, religions, and vast diversity remain underrecognized and misunderstood. This research aims to provide a local campus context to the United States through examining 1) negative sociopolitical outlook on the MENA region and it's peoples, 2) the political rhetoric on Islam as well as the conflation of Arab and Muslim, and 3) how MENA-Americans can be better served on campus and in the larger community.

98. Noah Sinclair

Major: Biomedical Engineering

Graduation: Spring 2023

Mentor: Dr. Edward Sander (Biomedical Engineering)

Fibroblast to Myofibroblast Conversion in Adipocyte Conditioned Medium

The conversion of fibroblasts to myofibroblasts is an important process in wound healing. However, overactive myofibroblasts are associated with excessive scarring and tissue fibrosis. Adipose tissues have been identified as active players in the wound healing process. To better understand how adipocyte stem cells, preadipocytes, and adipocytes might be used therapeutically to reduce scarring, and we have been exploring how conditioned medium from these cell types influences fibroblast conversion. To facilitate this investigation, we have developed a quantitative fluorometric assay that measures the amount of the cytoskeletal protein alpha smooth muscle actin (α -SMA), which is upregulated in myofibroblasts. Using this assay, we have determined that adipocyte conditioned medium contains a molecule(s) in the 30-100 kDa range that is not TGF- β 1. Additional studies to identify the molecule responsible for this process are ongoing.

102. Alexander Slack

Major: Chemistry

Graduation: Fall 2022

Mentor: Dr. Xueshu Li (Public Health)

Non-Target Analysis of PCB Metabolites in Serum of Mice Exposed to PCBs Via the Diet During Gestation and Lactation

Polychlorinated Biphenyls (PCBs) are environmental contaminants associated with adverse human health effects, including cancer and neurotoxicity. In

living organisms, such as mice, PCBs are metabolized by cytochrome P450 enzymes to hydroxylated metabolites. These metabolites are further metabolized to sulfates and glucuronides by hepatic sulfatases and glucuronidases. We hypothesize that different PCB levels may affect the PCB metabolism in mice exposed to an environmental PCB mixture during gestation and lactation. To test our hypothesis, we used the Fox River Mixture (FRM), a PCB mixture that mimics the PCB profile in fish from the Fox River. We exposed 8-week-old female mice to peanut butter only (control group, N=4) or peanut butter with PCBs (0.1 (N=6), 1 (N=7), or 6 (N=8) mg/kg body weight) for two weeks. Mice were mated and exposed further to the FRM throughout gestation and lactation. Animals were euthanized on postnatal day 28, and serum was collected. Serum aliquots were extracted with the QuEChERS method. The sample extracts were analyzed on a UHPLC-Orbitrap-MS system. Preliminary analysis identified several PCB metabolites, including OH-PCBs, PCB sulfates, OH-PCB sulfates, and MeO-PCB sulfates, in the serum samples.

104. Matthew Speranza

Major: Biomedical Engineering

Graduation: Spring 2024

Mentor: Dr. Michael Schnieders (Biomedical Engineering)

pH-Based Replica Exchange for Amino Acid Model Bias Parameterization

The replica exchange algorithm is an enhanced sampling algorithm for molecular dynamics simulations. The protocol calls for periodic exchange of parallel simulations dependant on the Metropolis Criterion. This specific implementation takes place within a constant pH molecular dynamics (CpHMD) run using the AMOEBA polarizable force field. The enhanced sampling allows simulations to have a greater statistical significance when compared to normal CpHMD runs. This allows for faster optimization of the bias parameter that needs tuning.

106. Jenna Springer

Major: Psychology, Health Promotion

Graduation: Fall 2022

Mentor: Dr. Michelle Voss (Psychological and Brain Sciences)

Physical activity matters: Investigating the relationship between white matter hyperintensities, vascular health, and executive function

With the growing aging population in the United States, the mitigation of normal age-related cognitive decline in older adults is essential to prevent burden on caretakers and our health care infrastructure. Executive function (EF), comprised of sub-processes like working memory, inhibition, switching, and attention (e.g., multitasking), shows decline early in aging and is crucial for maintaining independence. White matter hyperintensities (WMHs) are

age-related structural changes seen in older adults and are associated with decrements in EF. Their exact cause is unknown but is presumed to be of vascular origin. Physical activity (PA) is a behavior known to be effective in slowing cognitive decline by improving cardiovascular health. Studies exploring the relationship between WMHs and PA trend towards a negative association but have been mixed.

This study aimed to further inform the relationship between PA and WMHs by using accelerometer data, which may be better representative of normal weekly PA patterns compared to self-report measures in previous studies. Preliminary data results demonstrate a negative correlation between accelerometer-measured PA and WMHs and between WMHs and EF performance. To our knowledge, this is the first study to investigate the relationship between PA, WMHs, and EF using accelerometer data and an extensive EF measure.

108. Yabsira Tekle

Major: Human Health and Physiology

Graduation: 2023

Mentor: Dr. James Davis (Pediatric-Infectious Diseases)

Using the Zebrafish Model to Investigate the Role of Cryptococcal PLB1 in Infection and Dissemination Across the Blood Brain Barrier

Cryptococcus neoformans is a fungal pathogen that is commonly found in the environment. This fungus is known to cause Meningitis in human beings. Infection begins when an individual inhales its spores, which first settle in the lungs then later disseminates to the brain through the blood. In the brain the yeast crosses the blood brain barrier and begins to grow exponentially. The zebrafish is an efficient model used to study cryptococcal pathogenesis for various reasons. Zebrafish make it easier to visually track infection trends and process of dissemination through microscopy since they have transparent bodies during their early stages of development.

Previous studies have suggested that the deletion of Plb1 may play a role in preventing escape of the fungus from phagocytes. Although some of the effects of deleting the PLB1 gene is known, the process how this happens is not well understood. The purpose of this study is to understand the role of cryptococcal PLB1 infection and dissemination by creating a plb1 mutant and studying the infection and spread of the fungus to the brain.

110. Sanmati Thangavel; Cally Tucker

Majors: Human Physiology; Biochemistry

Graduation: Spring 2024; Spring 2024

Mentors: Drs. Marcelo Correia and Renata Alambert (Internal Medicine)

ER-stress inhibition protects C57 mice from high fat diet-induced weight gain

Dynamin-related protein-1 (DRP1) mediates mitochondrial fission in diverse tissues, including skeletal muscle. Previously we have investigated the metabolic effects of a skeletal muscle-specific knockout of (DRP1 KO) in C57 mice. DRP1 KO mice are resistant to weight gain induced by a high-fat diet related to a reduction in adipose tissue. They are more tolerant to glucose challenges associated with lower insulin levels. Gene expression of ATF-4, a transcription factor associated with endoplasmic reticulum (ER) stress activation was elevated in DRP KO mice. Furthermore, DRP1 KO mice have increased gene expression and plasma levels of GDF15 and FGF21, which we hypothesized was downstream from an increase in ER stress. To test this hypothesis, we chronically treated wildtype and DRP1 KO mice with tauroursodeoxycholic acid (TUDCA), a bile acid shown to alleviate ER stress. As opposed to the anticipated results, TUDCA did not rescue the weight phenotype in DRP1 KO mice and substantially protected wild-type mice from weight gain and glucose intolerance associated with a high-fat diet for 12 weeks. We now hypothesize that ER stress might have a bidirectional effect on weight and glucose homeostasis. It is possible that different pathways of the ER stress response might have distinct impacts on adiposity regulation.

112. Jacob Venenga

Major: Human Physiology

Graduation: Spring 2024

Mentor: Dr. Nathaniel Jenkins (Health and Human Physiology)

Acute, Dose-Dependent Supplementation of AmaTea MAX Improves Psychomotor and Motor Speed: A Randomized, Double-Blind, Placebo-Controlled, Crossover Trial

INTRODUCTION: AmaTea MAX is a dietary supplement consisting of caffeine and polyphenol antioxidants and has been marketed as a nootropic, or cognitive enhancing supplement. **HYPOTHESIS:** We hypothesized that AmaTea MAX would improve cognitive performance in a dose-dependent manner compared to placebo. **METHODS:** 26 healthy young adults (8M, 16F, age = 28 ± 7 y) completed three experimental visits and consumed either PLA, AMA600, or AMA1200 in randomized order (0mg, 150mg, and 300mg of caffeine, respectively). Following 60-minutes of quiet rest, participants completed neurocognitive testing (CNS Vital Signs). Independent, one-way repeated measures ANOVAs examined the differences between conditions. Tukey's post-hoc comparisons were used when applicable. **RESULTS:** Psychomotor ($p = 0.004$) and motor speed ($p = 0.007$) were greater following ingestion of AMA600 than PLA, but not AMA1200 and PLA ($p = 0.087$). Cognitive flexibility ($p = 0.053$) and executive function ($p = 0.053$) tended to increase following consumption of AMA600. **DISCUSSIONS:** AMA600 consistently demonstrated increased psychomotor and motor speed when compared to AMA1200 and PLA. These results potentially support an optimal supplementation dosage for psychomotor and motor speed; however, more studies are needed to examine the effect of dose-dependent supplementation of AmaTea MAX on cognitive performance.

114. Zach Vig; Mehdi Assem; Rebekah Brown; Kevin Hall

Majors: Geoscience, Physics; Physics, Mathematics; Physics; Physics
Graduation: Spring 2023; Spring 2023; Spring 2024; Spring 2026 (Grad);
Mentor: Dr. David Miles (Physics and Astronomy)

Detecting Iowa's CO₂ in the Stratosphere using the High Altitude Near Infrared Spectroscopy Experiment (HA-NICSE)

Atmospheric CO₂ concentration measurements are crucial in determining the effects and processes behind climate change. Although many surface-level CO₂ studies have been performed, there is a distinct absence of vertically profiled CO₂ data. By measuring the CO₂ concentration using Near Infrared Spectroscopy on Iowa State University's High Altitude Balloon Experiments in Technology (HABET) aircraft, we plan to characterize Iowa's atmospheric boundary layer, provide evidence of locally sourced CO₂ in the stratosphere and detect small-scale discrepancies in global CO₂ concentration models. Our instrument includes the use of a K30 FR CO₂ sensor in conjunction with Dynaflo 2000 series pumps to provide a calibrated, high resolution vertical profile of CO₂ concentration above Iowa. The experiment will be flown to 30km mainly above Iowa's farmland alongside two other scientific instruments from the University of Iowa. Once our data is collected, we plan to compare our measurements to theoretically derived and experimentally measured values to put Iowa's unique atmospheric environment into a global context.

116. Amelia Watson

Major: Psychology, Criminology, Law, and Justice
Graduation: Fall 2023
Mentor: Lilly Bendel-Stenzel and Dr. Danming An (Psychological and Brain Sciences)

Measuring discrete and global indicators of shyness: A coding system creation

Shyness is a commonly studied temperament dimension in young children. Research suggests that shyness may encompass various forms that differ in how (mal)adaptive they are. To study that heterogeneity, we observed 200 preschoolers in the "Performance Task", a paradigm typically used to elicit a shy response: Children were asked to sing or dance in front of an audience (a familiar adult and an unknown adult). Our behavioral coding system, adapted from past work (Colonnese et al., 2014; 2017), targets a rich variety of subtle behaviors and emotions: facial expressions, head/gaze aversion, tension, and limb movements. We also measure the intensity of behavioral and affective displays of shyness to allow for robust and sensitive final constructs. Once the coding is completed, we will be able to determine whether we can distinguish certain patterns of shyness that are differentially associated with multiple other measures we have for these children (e.g., fear, anxiety, social withdrawal, exuberance, internalizing problems). Although most typically developing young children display some degree of shyness in unfamiliar or

stressful situations, excessive shyness may indicate a risk for future anxiety disorders. Understanding the heterogeneity of shyness responses is important in that it can inform parenting prevention and intervention programs.

118. Elizabeth Wetzel

Major: Human Physiology, Pre-Medicine

Graduation: Spring 2024

Mentor: Dr. Anna Stanhewicz (Health and Human Physiology)

E-cigarette flavoring does not differentially reduce microvascular endothelial function in healthy young adults

Purpose: Young men and women who use e-cigarettes have attenuated endothelial function assessed in the conduit (brachial artery) vasculature. Preclinical studies suggest that the flavoring added to e-cigarette liquid may differentially attenuate endothelial function. However, these results are equivocal. The aim of this study was to examine differences between e-cigarette flavoring on microvascular endothelial dysfunction in healthy young chronic (users ≥ 6 months) e-cigarette users (EC) compared to age-matched control participants who had never used e-cigarettes (HC). Methods: Using the cutaneous circulation as a model, we examined the effects of the 2 most common flavor additives (menthol $n=2$, fruit/candy $n=5$; combo $n=3$) used by our participants. 11 EC (21 ± 2 yrs) and 20 HC (21 ± 2 yrs) underwent a standard local heating protocol (42°C ; $0.1^\circ\text{C}\cdot\text{s}^{-1}$). One microdialysis fiber was placed in the ventral forearm for the local delivery of pharmacological agents. Lactated Ringer's was perfused at baseline and during local heating. After full expression of the local heating response, 15mM NG-nitro-L-arginine methyl ester (L-NAME; NO synthase-inhibition) was perfused. Red cell flux was measured continuously by laser-Doppler flowmetry, and cutaneous vascular conductance ($\text{CVC} = \text{flux}/\text{MAP}$) was standardized to maximum ($\% \text{CVC}_{\text{max}}$; 28mM SNP + 43°C). Results: Compared to HC, EC had attenuated endothelial- ($p=0.007$) and NO- ($p=0.018$) dependent dilation. However, there were no differences between flav

120. Micah Williams

Major: Psychology

Graduation: Spring 2024

Mentor: Dr. Isaac Petersen (Psychological and Brain Sciences)

Child Externalizing Problems Predicting Later Depressive Symptoms: Comparing Multiple Stressors as Mediators

The present study examined multiple types of stress as potential mediators of the association between child externalizing behaviors and parent depressive symptoms. Stressors examined included negative, problematic perceptions surrounding parenting (parenting-related distress), the degree of normative, everyday experiences of parenting difficulties (parenting daily hassles), and more general life events stress. We hypothesized parenting-related distress to explain the most variance given that it reflects the perceived difficulty of the

parent–child relationship. The sample included 126 children ages 3–7 years, parents, and secondary caregivers (daycare providers, teachers, relatives) from a longitudinal study. After analysis through structural equation modeling, parenting-related distress was established as a possible mediator in the association between children’s externalizing behaviors and later parent depressive symptoms. This study compared multiple stressors and supports that parenting-related distress robustly predicts later parent depression. Results suggest the importance of targeting parenting-related distress, more so than daily parenting hassles or general life events, to prevent future depression in response to children’s externalizing behavior. The present study demonstrates the value of examining multiple types of stressors simultaneously to elucidate mechanistic linkages between child and parent psychopathology.

122. Meghana Yellepeddi

Major: Ethics and Public Policy, Interdepartmental Studies

Graduation: Spring 2023

Mentor: Dr. Whitney Zahnd (Health Management and Policy)

Cervical Cancer Screening Utilization in Rural FQHCs Across Clinic Characteristics

Rural Federally Qualified Health Centers (FQHCs) play a key role in addressing cervical cancer screening inequities, but its unknown what factors contribute to better utilization of services. Using 2019 Uniform Data System data on FQHC grantees, the average percentage of up-to-date cervical cancer screenings were compared based on clinic quality metrics, Electronic Health Records (EHR) characteristics, and region. On average, 47.9% of grantee patients were up-to-date on cervical cancer screening. For patient-centered medical homes (PCMHs) grantees, 49.5% were up to date compared to 43.3% that were not. For grantees with health information technology designation (HIT), 48.9% were up-to-date compared to 46.4% that were not. Clinics with a quality badge designation had higher average rates of cancer screening than clinics with no designation. Among clinics with quality badge designation, gold had the highest average up to date (62.7%). In general, those FQHC grantees whose EHRs could communicate with other clinics/hospitals and with patients via patient portals or secure messaging had higher average screening rates than those that did not. Regionally, FQHCs in the Northeast had the highest average (55.4%) followed by Midwest (48.1%), South (46.8%), and West (46.2%). Future research should explore what other characteristics impact screening to inform interventions.

124. James McMillan

Majors: Public Health, Ethics and Public Policy

Graduation: Fall 2022

Mentor: Stephanie DiPietro (Sociology and Criminology)

Impact of Violence over the Life Course

I am using grounded theory qualitative coding to examine case study

interviews conducted by Dr. DiPietro in Bosnia. These interviews are examining what impact experiencing violence has on behavior in the life course of individuals who lived through the Bosnian civil war/genocide in the 1990s. And within the coding process, my goal is to find common threads and themes that help explain and illustrate behavioral trends. That in turn helps us have a better understanding of how a person reacts and what options they have whether they are perceived or not to these very intense situations like what happened with the genocide in Bosnia in the 1990s. And the very real impacts can even be seen now over 25 years later.

126. Pedro Marra

Major: Biomedical Sciences

Graduation: Spring 2023

Mentor: Dr. Gen Shinozaki (Psychiatry)

Metformin use history and genome-wide DNA methylation profile: potential molecular mechanism for aging and longevity

Background: Metformin, a commonly prescribed anti-diabetic medication, has repeatedly been shown to hinder aging in pre-clinical models and to be associated with lower mortality for humans. It is, however, not well understood how metformin can potentially prolong lifespan from a biological standpoint. We hypothesized that metformin's potential mechanism of action for longevity is through its epigenetic modifications.

Methods: To test our hypothesis, we conducted a post-hoc analysis of available genome-wide DNA methylation (DNAm) data obtained from whole blood collected from inpatients with and without a history of metformin use. We assessed the methylation profile of 171 patients (first run) and only among 63 diabetic patients (second run) and compared the DNAm rates between metformin users and nonusers.

Results: Enrichment analysis from the Kyoto Encyclopedia of Genes and Genome (KEGG) showed pathways relevant to metformin's mechanism of action, such as longevity, AMPK, and inflammatory pathways. We also identified several pathways related to delirium whose risk factor is aging. Moreover, top hits from the Gene Ontology (GO) included HIF-1 α pathways. However, no individual CpG site showed genome-wide statistical significance ($p < 5E-08$).

Conclusion: This study may elucidate metformin's potential role in longevity through epigenetic modifications and other possible mechanisms of action.

