

The 12th Annual



Fall

Undergraduate

Research

Festival

Wednesday, November 10, 2021
4:30pm-6:30pm

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 Coordinator
Melinda Licht
melinda-smits@uiowa.edu**

**icru.research.uiowa.edu
6 Gilmore Hall
319.335.8336
icru@uiowa.edu**

The 2021 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 4:30-5:30PM
Even numbered posters will present from 5:30-6:30PM

****Please note that at 5:30, 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 - February 1, 2022
- Distinguished Mentor Award - February 1, 2022
- ICRU Research Fellowship Applications Due:
 - *Summer - April 1, 2022
 - *Academic Year - April 22, 2022
- Research in the Capitol - February 21, 2022
- Spring Undergraduate Research Festival (SURF) - TBA

4:30-5:30PM Presenters (odd numbers only)

1 - Andrew Behrens

Major: Biomedical Engineering

Mentor: Dr. Kevin Dibbern (Orthopedics)

Three-Dimensional Coverage Maps in the Assessment of Chopart Subluxation in Progressive Collapsing Flatfoot Deformity

Progressive collapsing foot deformity (PCFD), formerly termed Adult-Acquired Flatfoot Deformity, is a complex 3D deformity characterized by peritalar subluxation (PTS) of the hindfoot through the triple joint complex. In this context, adjacent structures may adopt different positions and boney relations can change, producing areas of increased contact or subluxation. The objective of this study was to develop 3D distance maps (DMs) and coverage maps (CMs) from weightbearing CT (WBCT, PedCAT; Curvebeam) data to assess subluxation across the Chopart joint in PCFD and controls. We hypothesized that CMs would show decreased coverage indicative of subluxation through certain regions of the Chopart joint in PCFD patients when compared to the controls.

3D-DM and CM are reliable tools to assess the Chopart in PCFD. Our results reflect more an abduction pattern of the talonavicular joint than a sagittal sagging. The motion of the calcaneocuboid joint in PCFD is not described in the literature. Our results support the fact that the calcaneocuboid appears to follow the subluxation of the talonavicular joint without being the initiator of the PTS. Larger cohorts, include clinical data and combine these results to those of surroundings joints would increase the relevance of these findings.

3 - Scott Bell

Major: Biomedical Engineering

Mentor: Dr. J. Muse Davis (Pediatrics)

Macrophages harbor a Cryptococcus neoformans mutant with irregular extracellular proliferation.

Cryptococcus neoformans is a fungal pathogen that kills ~600,000 people every year, mainly targeting immunocompromised individuals in underdeveloped communities. Initially, the fungus is inspired into the lungs where it can then proliferate, seed the bloodstream, and spread to the brain to cause meningoencephalitis. Along the way, the pathogen survives and proliferates in both an acidic niche in macrophages and in the more alkaline, CO₂ rich environment of the bloodstream. Understanding how *Cryptococcus* can thrive in

differing environments will lead to a better understanding of pathogenesis and to the development of novel treatments for the disease.

One cryptococcal mutant, *gcs1Δ*, has been shown in mice to survive poorly in the extracellular environment, despite growing well inside macrophages. In this mutant, the absence of GCS1 (glucosylceramide synthase 1) alters the production of membrane sphingolipids. We used the zebrafish model of cryptococcal infection to examine this mutant in greater detail. In Zebrafish we do not see a difference in extracellular proliferation, but mutant yeast that do survive extracellularly often form unique tight aggregates not seen in the WT, perhaps in order to regulate their environment. Here we show that *gcs1Δ* proliferates in the acidic environment of macrophages after intravenous infection and we find that the pathology of extracellular proliferation is unaffected by depletion of macrophages. These findings further our understanding of extracellular survival during cryptococcal pathogenesis.

5 - Esmee Belzer

Majors: Chemistry | Statistics

Mentors: Dr. Tori Forbes, Dmytro Kravchuk (Chemistry)

Interaction of humic acid and uranyl cations in aqueous environments

Uranium is a naturally occurring radioactive metal, commonly mined and used for energy applications. Such mining operations can result in uranium leaching into ground water, leading to contamination of water sources, which in turn, leads to public health concerns due to radioactivity and chronic toxicity associated with uranium. In aquatic systems, uranium presents itself as a linear U(VI)O₂²⁺ cation that displays complex reactivity in natural waters due to varying pH, multitude of ions, and naturally occurring organic matter. Natural organic matter (NOM) is a mixture of organic molecules that, despite an unknown exact composition, can bind the uranyl cation and become a mobile uranium carrier in the environment. The chemistry of uranyl-NOM adducts is further complicated by their interactions with natural sunlight (UV) that are hypothesized to cause the breakdown of NOM. This study focuses on the interaction of humic acid (HA), a NOM-derivative, with uranyl nitrate in the presence of UV light at a range of pH values (pH 2, pH 4, pH 7). Solid and solution-state Raman spectroscopy, absorption spectroscopy, and single crystal X-ray diffraction were utilized to probe the chemistry of uranyl-NOM solutions. In presence of UV light, initial findings suggest uranium-catalyzed breakdown of HA to form oxalate anion and, subsequent precipitation of uranium in form of a mineral phase schoepite.

7 - Reese Bobitt

Major: Political Science

Mentor: Dr. Brian Lai (Political Science)

Who Should Be Held Accountable For the Climate Refugee Crisis?

This research proposes policy-based mitigation strategies to address the global climate refugee crisis. This project also aims to develop indicators of climate change as they relate to displaced persons and major contributors. This is achieved by assessing the environmental impact of high polluting countries and the needs of climate refugees affected by them.

The climate refugee crisis puts a massive financial strain on countries that are receiving the highest numbers of climate refugees. To offset this burden, the countries that are the biggest contributors to climate change should be held responsible for financially supporting climate refugees as they relocate to countries, ideally within their own regions, languages, or cultures.

While there are many metrics by which climate change contributors can be measured, high levels of carbon dioxide emissions are generally a good indication of which countries should take on primary financial responsibility. Not only would this policy ease the transition of climate refugees and the countries that house them, but it would also incentivize countries with high pollution rates to reduce their emissions and consider the global repercussions of their carbon dioxide production.

9 - Cecelia Bonilla

Major: Criminology

Mentor: Dr. Karen Heimer (Sociology & Criminology)

Juvenile Justice: The Incarceration of Youth in the U.S.

Although research on incarceration within the United States has been happening for decades, the incarceration of juveniles has not received much attention. When considering race and ethnicity, little research has been done to examine disparities in the juvenile justice system. In this study I considered the work of Barry Krisberg, Michael Leiber, Nancy Rodriguez, and other scholars in order to create a comprehensive view of the juvenile justice system. This information along with data from the Office of Juvenile Justice and Delinquency Prevention provided the proper information to examine incarceration of juveniles by race/ethnicity. This comparison of juvenile incarceration by race/ethnicity allowed for disparities in the juvenile justice system to be identified.

11 - Hunter Briggs

Major: Health & Human Physiology

Mentors: Drs. Cesar de Cesar Netto, Matthieu Lalevee, Dr. Kevin Dibbern
(Orthopedic Functional Imaging Laboratory)

Coronal bone rotation of the medial column in hallux valgus: A retrospective case control study with Weight-Bearing-CT assessment.

The study is aimed to compare the coronal rotation of the medial column in halux valgus (foot bunions) and control groups. We performed an IRB approved retrospective study including 36 halux valgus and 20 control feet. The coronal rotation of each bone of the medial column (Navicular, medial cuneiform, and first metatarsal) were measured using a WBCT software.

13 - Joshua Brown

Majors: Public Health

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

Laying the groundwork for identifying neurodevelopmental impacts of PCB exposure during adolescence

Polychlorinated biphenyls, commonly referred to as PCBs, are a class of organic, manmade chlorine compounds. PCBs were commonly used in electrical equipment and construction materials into the late 1970s. Since then, a significant body of literature has found that exposure to PCBs can lead to numerous adverse health outcomes in adult humans, such as loss of body weight, higher risk for certain cancers, and neurodevelopmental deficits. However, the neurotoxic effects of exposure to PCBs during adolescence have received limited attention to date. The objective of this study was to determine the amounts of PCB52 (2,2',5,5'-tetrachlorobiphenyl), a PCB congener often found in the air of older school buildings, and its metabolites in adolescent rats following inhalation exposure to PCB52. This research is an ongoing project consisting of systematic reviews, animal studies, and data analysis. This research will lay the foundation for future studies to identify the neurotoxic effects of PCB inhalation during adolescence.

15 - Theodore Byrnes

Majors: Chinese | Linguistics (TESL)

Mentor: Dr. Louise Seamster (Sociology & Criminology)

Operationalizing Email Informality in the Flint Water Crisis

Between the months of January and August 2016, in response to mounting local pressure and international attention, Michigan Governor Rick Snyder publicly released over 150,000 pages of emails obtained from government agencies

implicated for their roles in the Flint Water Crisis, comprising the Flint Email Corpus. Informed by symbolic boundaries theory and previous work on behavioral informality in the workplace (Morand 1995) and email informality in the workplace (Peterson et al., 2011), this project seeks to create a working operationalization of informality in emails for use in analysis of this dataset. Because informality serves as an indicator of perceived shared identity and group membership, tracking patterns of formality and informality in the corpus illuminates relationships between organizations and actors involved in the Flint Water Crisis and contextualizes decisions which led to harm. A combination of traditional qualitative coding and quantitative analysis were used to examine the relative efficacy of the coding scheme at reflecting human intuitions about formality and informality. The results will inform the creation and training of a machine-learning algorithm which will allow for large-scale analysis of the corpus impossible to achieve through traditional qualitative methods

17 - Megan Christianson

Majors: History and International Relations

Mentor: Dr. Tyler Priest (History)

Legislating the Landscape: The Battle for a Federal Wilderness Bill for Montana, 1979-1988

In 1988, Congress passed the Montana Natural Resources Protection and Utilization Act. It was the culmination of nearly a decade of fierce public debate, involving local and national forces including timber and mining industry interests, conservation groups like the Wilderness Society and Sierra Club, and local groups like the Blackfeet Tribe, farmers and ranchers, and recreationists. Despite broad support from Congress, and a previous record of passing other wilderness designation bills, President Reagan killed the bill with a pocket veto. This research examines the contributions of interest groups and the larger political forces at play in the late 1980s.

19 - Maddy Daley

Majors: Chemistry | Music | Science Education

Mentors: Dr. Max Lei Geng, Hong Bok Lee (Chemistry)

Probing Structural Evolution of Stationary Phase in Chemical Separations with Free Energy Imaging

Chromatographic separations are indispensable in drug discovery, medical diagnostics and environmental monitoring. A long-standing problem, as outlined by the National Academies in the report "An Agenda to Transforming Separation Science", is to understand how the separation system evolves over time when it is used in sample separations. The overarching goal of our research project is to study the time evolution using quantitative confocal fluorescence imaging.

23 - Samuel Eliassen

Major: Neuroscience

Mentor: Dr. Hanna Stevens (Psychiatry)

Cypermethrin Induces Changes in Fetal Microglia Populations and in Placental Immune Cells

Pyrethroids are a class of insecticide and neurotoxin. These chemicals are commonly used in the household and are present in products like pest sprays and pet leashes. Though normal dietary exposure to pyrethroids is commonly considered safe for adults, the subtle effects of certain compounds on the developing nervous system is understudied. Research has correlated high prenatal exposure to the pyrethroid cypermethrin to delayed cognitive development in humans. In animal models, studies have shown that similar exposure delays neuron progenitor migration and alters microglia development. We analyzed densities of microglia in the fetal forebrain of mice at embryonic day sixteen following ten days of maternal dietary exposure to the pyrethroid cypermethrin. Microglia populations were estimated with a stereological counting approach after brain sectioning and immunohistochemical staining. Our examination also included analyses of related placental macrophage populations using the same approach. We then compared each cell population to see whether changes in one group were recapitulated in the other. Our data show different dose-dependent response patterns for total macrophage densities in the placenta and for total microglia densities in the forebrain. These findings suggest that cypermethrin affects both microglia and macrophage cell populations differently after departure from the yolk sac.

25 - Laura Evans

Major: Neuroscience

Mentor: Drs. Mark Blumberg and Greta Sokoloff (Psychological & Brain Sciences)

Facial Twitching In Sleeping Human Infants: Expression Of Emotion Or Mere Movement?

I conducted a longitudinal analysis of the emergence and spatiotemporal organization of self-generated twitches of the facial muscles during sleep. This analysis was conducted using previously collected video and EEG data of sleeping infants at 0 to 6 months of age. Facial twitches are prominent in the early postnatal period during active (REM) sleep, accompanying twitches of the limbs and rapid eye movements. Occasionally, these facial movements cluster together and observers may perceive this to be expression of emotion during sleep. I investigated variability in facial twitching across age and classified twitches into individual and combination twitches of the mouth, brow, eye, and nose muscles.

We found facial twitching occurs predominately in active sleep. Further, in alignment with previously data concerning limb twitching, facial twitching decreases with age. Combination facial twitches, which where two different

parts of the face twitch within one second of each other, occur less than half the time. Because combination facial twitches activate multiple parts of the face, to an observer they may resemble affect. However, we propose this activity is merely the wiring of facial motor system, with no underlying emotional component.

27 - Jordan Ewald

Major: Biomedical Engineering

Mentors: Drs. Sue O'Dorisio and Claudia Robles (Pediatrics)

Toxicity of Novel Radiopeptides on Stem Cells

Peptide Receptor Radionuclide Therapy (PRRT) is an emerging treatment for specific cancers revolving on the targeting of cell surface markers. This personalized treatment aims to reduce the peripheral damage associated with many other forms of cancer treatment. However, the peptide used to connect the radioactive material to the cell of interest also target the markers on certain stem cells. To our knowledge, there is no literature describing the potential damage to stem cells with PRRT making a high demand to understand how these treatments can be given while also protecting a patients overall health. TO investigate the potential damage, stem cells in murine models and from umbilical cord blood are analyzed after exposure to PRRT through CBC analysis, flow cytometry, and pathology.

29 - Meghan Funk

Major: Mathematics

Mentor: Dr. Donna Santillan (Obstetrics & Gynecology)

Determining whether aberrant vasopressin concentrations persist postpartum

Preeclampsia (PreE) is a common hypertensive disorder during the latter half of pregnancy. It is estimated to affect 5-7% of all U.S. pregnancies. PreE leads to increased risks of fetal abnormalities, pregnancy complications, chronic hypertension, and cardiovascular disease. Arginine vasopressin (AVP) is a hormone which functions as blood pressure regulator. AVP is secreted by the hypothalamus as a proprotein with copeptin. Because copeptin and vasopressin are secreted in a 1:1 molar ratio, copeptin measurements can be used a surrogate measure of vasopressin. Our lab has previously demonstrated that vasopressin is elevated throughout preeclamptic pregnancies. However, we do not know if vasopressin remains elevated chronically. In order to fill this knowledge gap, we measured the AVP concentration in urine from both non-preeclamptic and preeclamptic subjects 1-4 years postpartum. Urine samples (IRB# 201808705) were investigated for copeptin concentrations via an automated immunoassay (Brahms KRYPTOR), creatinine concentrations via a QuantiChrom assay, and total protein concentrations via a bicinchoninic acid (BCA) protein assay. We did not identify a statistically significant difference in AVP in the postpartum period between non-preeclamptic and preeclamptic

women. Therefore, vasopressin concentrations are not chronically altered by preeclampsia.

31 - Bailey Garnica

Major: Health & Human Physiology

Mentor: Dr. Martine Dunnwald (Anatomy & Cell Biology)

The Role of ARHGAP29 in Keratinocyte Migration

The Rho GTPase Activating Protein, ARHGAP29, is a protein that inactivates the small GTPase RhoA. RhoA is a critical modulator of the actin cytoskeleton, which is required for cell morphology and migration. Therefore, we hypothesize that reduction of ARHGAP29 will lead to an increase in cell size and amount of filamentous actin, subsequently leading to a decrease in cell migration. In order to test this hypothesis, we knocked down ARHGAP29 (A29KD) in keratinocytes using both small hairpin RNA and CRISPR technologies. A29KD cells were larger and had increased filamentous actin compared to control cells. Using a scratch assay, migration of keratinocytes was assessed over 24h. Following single cell migration analysis, A29KD cells demonstrated impaired migration with reduced directionality, speed, and persistence. Treatment with the ROCK inhibitor Y-27632, a drug that is used to study rho-associated protein-kinase signaling pathway, rescued the ARHGAP29-dependent migration defect to baseline control values. Similar experiments were also performed under conditions promoting collective cell migration. Our results show that A29KD cells demonstrated impaired closure 12 hours after the scratch, which was rescued by transducing ARHGAP29 back into the A29KD cells. In conclusion, we show that ARHGAP29 is critical for keratinocyte morphology and migration.

33 - Sophia Gilbert

Majors: History | Political Science

Mentor: Dr. Leslie Schwalm (History)

The Direction of Lesbian Organizing During the Reagan-Bush Era

My research investigates the direction of lesbian organizing during the Reagan-Bush administration, focusing primarily on the lesbian and feminist quarterly Common Lives/Lesbian Lives (CLLL). The publication of this work by lesbian-feminists who moved from Los Angeles to Iowa City to collaborate with the similarly lesbian-feminist Iowa City Women's Press (ICWP) coincided with the dwindling lesbian-feminist movement, the rise of conservatism, and the beginning of the HIV/AIDS epidemic. While several histories of 1980s lesbian organizing describe lesbians' collaboration with gay men or the discourse of the sex wars, few focus specifically on how lesbian-feminist ventures unfurled following the separatist-focused 1970s. My study of the quarterly's pages, correspondence, legal battles, advertisements, and other organizing documents places CLLL in historical conversation with academics who posit that in the 1980s, the exclusionary aspects of lesbian-feminism gave way to efforts at

inclusivity and anti-racism among lesbian organizers. Attempts by the CLLL collective to print a diversity of voices, and to combat their own racism as a majority-white collective, show an effort to create anti-racist accountability through a print network of lesbians. The failure of the ICWP in the mid-1980s, however, represented a loss to lesbian infrastructure which seriously threatened CLLL's vision and highlighted the contemporary importance of lesbians owning the means of production.

35 - Noah Gilkes

Major: Neuroscience

Mentor: Dr. Elizabeth Newell (Pediatrics)

The role of type I interferon signaling in mice following experimental traumatic brain injury.

Traumatic brain injury (TBI) is a leading cause of morbidity and mortality worldwide, impacting an estimated 3 million people annually in the United States¹. Traumatic brain injury has also been shown to cause significant morbidity and mortality in children, with nearly 500,000 emergency room visits for children each year.² TBI during childhood can have detrimental effects on neurodevelopment, and often results in long-term neurological dysfunction. Following a TBI, secondary injury responses can exacerbate neurodegeneration, as seen in previous experimental and clinical studies¹. Adult and juvenile male C57BL/6J mice underwent either fluid percussion or sham injury. Traumatic brain injury leads to a significant increase in the expression of type I interferon stimulated genes in localized brain tissues at subacute timepoints. Subject age may account for interferon response and subsequent TBI recovery. Adult mice deficient in the interferon receptor (IFNAR^{-/-} mice) were used to characterize the impact of type I interferon response on TBI recovery. Genetic knockout of the interferon receptor (IFNAR^{-/-}) alleviated the gene expression of several critical type I interferon pathway modulators. Studies are underway to assess the impact of type I interferon deficiency on neurodegeneration and neurologic function following experimental TBI.

37 - Will Golay

Majors: Astronomy | Physics

Mentor: Drs. Robert Mutel, Caroline Roberts (Physics & Astronomy)

Spectroscopic Instrumentation for Small Optical Telescopes

High quality spectrometers are a noticeably absent feature from small, optical research telescopes. We propose two designs, one that can image very dim sources, and another that is restricted to brighter sources but provides much higher resolution. The first design is called a grism, or grating-prism spectrometer, and is constructed by placing five optical elements in-line held together by a 3D-printed housing, which can easily fit inside an extended filter wheel. The second design utilizes a multimode optical fiber pickoff to redirect light from the telescope to a commercial spectrometer, capable of high

resolution across the entire optical band. The multimode fiber allows for spectroscopic sampling of 19 fields simultaneously, including non-point sources, such as galaxies and nebulae. The pickoff is easily installed in an already-present spacer, making integration simple and non-intrusive. These designs are currently being tested and implemented on the Department of Physics and Astronomy's Van Allen Observatories, including the Gemini Telescope at the Iowa Robotic Observatory in Sonoita, AZ. These instruments are easy to use, capable of producing research-grade data, and available to all undergraduate astronomy lab students, providing endless learning opportunities to anyone new or experienced in the field of astronomy.

39 - Sean Michael Gomendoza

Major: Biomedical Sciences

Mentor: Dr. Xiangbing Meng (Pathology)

Validate PR regulators by CRISPR interference (CRISPRi)-mediated transcriptional repression

Cancer progression is strongly influenced by oncogenic expression patterns; over- or under-expressed essential regulatory genes have traditionally been targeted by CRISPR-mediated knockout or recombinant transfection methods that permanently alter the expression and structure of genes. These methods can rescue or eliminate aberrant expression, but often fail to introduce transient mechanisms to modulate the introduced changes. Uterine endometrial cancer (UCEC), the most common gynecological cancer, has progression patterns uniquely dependent on progesterone deficiency and unresponsiveness; consequently, Progesterone Receptor (PR) expression is incredibly indicative of clinical outcomes. Our GeCKO library, in tandem with our transfected PR reporter system, has previously screened and verified UCEC-specific oncogenes. Candidates selected for this project significantly downregulate PR expression, limiting the ability of progesterone to inhibit unchecked endometrial cell growth. Here, we incorporate a previously-discussed modified CRISPR-Cas9 system with sgRNA plasmids uniquely specific to promoter sequences to create a mechanism by which gene expression can be impermanently modulated. Verification by Western blot and RT-PCR confirmed the downregulated expression of targeted genes and inverse upregulation of PR by way of decreased mRNA production. This two-plasmid system shows promise in temporarily controlling expression and in mediating responsiveness to traditional progestin-based therapies for UCEC.

41 - Maria Gorham

Major: Spanish

Mentor: Dr. Kristine Muñoz (Spanish & Portuguese)

Language, Social Stratification, and "Vínculos:" How the paisa dialect constructs social identity in Medellín, Colombia

Medellín is the second largest city in Colombia and is best known for media images of violence and narco-trafficking. This research project took a

sociolinguistic approach, showing how the unique system of language use, known as the paisa dialect, serves to illustrate personal identity, social ties (“vínculos”), and position in a hierarchical class system. Through literature, film, and speech samples, we show how language use constructs identity, creates social ties, and maintains a collectivist cultural ideology present throughout this region. Evidence on semantic, pragmatic, and phonetic levels of this dialect show a distinctive system of language use in which people connect with one another socially and depend on each other for both survival and status in Medellín. A further aspect of the project was its destination and audience: a public digital humanities website intended for educational use by students and teachers of Spanish.

43 - Wesley Hanson

Major: Microbiology

Mentor: Dr. Wendy Maury (Microbiology & Immunology)

Evaluation of Novel Receptors Facilitating Ebolavirus Infection of Human Keratinocytes

Ebolaviruses are negative sense, single-stranded RNA viruses within the Filoviridae family and are known for the distinctive viral hemorrhagic fever (VHF) they cause. Particularly significant to human health is Zaire Ebola Virus (EBOV) accounting for a significant portion of major outbreaks in Africa. Ebolaviruses present a significant public health burden in Africa, and increased understanding of viral dissemination and transmission is essential for development of novel therapeutics. Ebolaviruses have been shown to infect and replicate in human keratinocytes, cornified cells that make up a majority of the epidermal layer of the skin. This infection is hypothesized to play an important role in person-to-person transmission. Preliminary studies have shown a variety of previously identified cell surface receptors facilitating EBOV infection have minimal significance to infection of keratinocytes, suggesting a novel receptor may be used by EBOV for entry into these cells. To identify potential surface receptors for EBOV infection of keratinocytes, a CRISPR/Cas9 knockout assay was conducted. The assay identified 4 candidate receptors: CDH3, LOX1, IGSF11, and OR5L2. These proteins have characteristics consistent with other identified viral receptors (surface level expression, ligand binding, endocytic potential, etc). Of the 4 candidates, CDH3 and LOX1 appear to enhance viral infection of transfected cells.

45 - Reagan Hart

Major: History

Mentor: Dr. Elizabeth Yale (History)

“Injure Their Reputation, and Terminate Their Life”: Privacy for Venereal Disease Patients in Early Modern England

Venereal disease was a large concern for people in eighteenth century England. Medical practitioners who treated venereal disease were concerned about the spread and treatment, and venereal disease patients were concerned about other people knowing about their disease. Venereal disease was associated with sinful acts of the time like adultery and premarital sex. This caused a lot of shame surrounding venereal disease, and one's reputation could have been negatively affected if others found out about their venereal disease diagnoses. This project explores the concept of privacy and the relationship between medical practitioners and patients in venereal disease cases through medical practitioners published medical books. The shame of being diagnosed with venereal disease led to the notion of medical privacy. Although many offered privacy, medical practitioners discussed a patients want for privacy as a problem. Medical practitioners worried that patients hiding their disease from others or from them would lead to greater spread and them not being able to treat patients. This created a sense of medical anxiety that anyone could have the disease. The concept of medical privacy was part of morality control, and medical practitioners blamed many for the diseases' spread in 1700s England.

47 - Bailey Hollis

Major: Health & Human Physiology

Mentor: Dr. Li-Chun (Queenena) Lin (Iowa Neurobank Core)

Possible Neurodegenerative Impact of SARS-CoV-2 (COVID-19) on the Human Brain

Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) is the pathogen responsible for the Coronavirus disease 2019 (COVID-19) pandemic, which has resulted in global healthcare crises and strained health resources. COVID-19 is now recognized as a multi-organ disease with a broad spectrum of manifestations. This pandemic is affecting populations around world, but in different ways. It is currently unclear about how COVID-19 affects the brains of COVID-19 patients, especially elderly populations with existing conditions. To provide insight as to why individuals with known risk factors are vulnerable to COVID-19 and its impact on their brains, we plan to identify new pathways for target discovery of microscopic changes in human COVID-19 brain regions using techniques for localizing gene expression within tissues and unbiased whole-brain imaging. In addition, we will qualitatively measure over multiple genes across neuro-inflammation pathways to provide a blueprint of neuropathology of COVID-19 throughout the human lifespan. This project will help us expand the existing efforts to multiple brain regions, and in samples from diverse age cohorts to uncover details of COVID-19. We hope that this will help us understand future consequences of those affected and better prepare for those who may still become affected.

49 - Madi Holm

Major: Nursing

Mentors: Drs. Debra Brandt, Donna Santillan (Obstetrics & Gynecology)

Comparing AHA gold standard blood pressure measurement in pregnant women to electronic home monitoring and clinical measurement

Hypertensive disorders in pregnancy is a leading cause of maternal death. Accuracy of blood pressure measurement (BPM) is crucial to making the correct diagnosis and treatment.

The American Heart Association (AHA) released recommended guidelines for performing BPM for accurate blood pressure measurement (BPM).

Furthermore, blood pressure can be falsely elevated in the clinic due to "white coat hypertension." The use of mobile health technologies used at home, is one thought in eliminating white coat hypertension.

Our study aimed to fill a critical gap in knowledge of how blood pressure measurement using the AHA guidelines compared to clinical blood pressures and home BPM in pregnant women.

Our analysis demonstrated a significant statistical difference between BPM taken with AHA guidelines compared to BPM at clinical appointments. Additionally, we identified a statistically significant difference between BPM recorded following the AHA guidelines compared to those recorded at home using electronic device.

This reinforces the importance of following the AHA-recommended guidelines both in the clinic and at home. It is notable that lower systolic and diastolic measurements were obtained at home compared to the clinic. Although not statistically significant, lower readings at home may indicate that clinic measurements are elevated due to white coat hypertension.

51 - Hiatt Holman

Majors: Political Science | Ethics & Public Policy

Mentor: Dr. Brian Lai (Political Science)

The Effect of a State's Human Rights Record on Their Extradition Requests

How does a state's human rights record influence its ability to get wanted fugitives from other countries? Drawing on existing work, we argue that a country's human rights record and high profile human rights events should reduce the percentage of fulfilled extradition requests to other countries. We analyze this argument using data on the European Arrest Warrant for most EU countries from 2000-2018. We find general support for our argument.

53 - Lillian Jones

Major: Chemistry

Mentor: Dr. Elizabeth Stone (Chemistry)

A scalable passive method for the quantification of airborne allergens

24 million Americans experience season health disorders caused by exposure to aeroallergens, such as pollen and mold spores. Traditionally, airborne concentrations of aeroallergens are sampled with the Hirst spore trap, which requires electricity and daily maintenance. However, aeroallergen concentrations may vary widely over urban and rural environments requiring a cost-effective and scalable quantification method. We developed such a method that uses passive sampling and microscopy for analysis. Inexpensive and easy to operate, passive samplers rely only on the gravitational settling of particles onto a microscope slide. To investigate the accuracy and precision of the passive method, four samplers were deployed during the 2020 ragweed season in Iowa City. Samples were collected using the Hirst trap and the passive method. The pollen concentrations for four periods were calculated using the deposition velocity model proposed by Wagner and Leith (2011). The passive sampling accuracy was satisfactory with an average difference of 30% between the two methods. The coefficients of variation across co-located passive samples ranged from 15% to 40%, suggesting general agreement. The operating procedures are undergoing advancement automated image analysis and sample size optimization. The validation of passive samplers will enable further measurements of aeroallergens over wider spatial scales, determine where exposures occur, and mitigate their negative effects on human health.

55 - Andrew Kain

Major: Neuroscience

Mentor: Dr. Ed Wasserman (Psychological & Brain Sciences)

Biological vs Artificial Intelligence: Can Either Solve the Subdivided Concentric Rings Categorization Task?

A leading theory proposes that humans possess two separate categorization systems: a declarative (rule-based) system and an associative (stimulus-response) system. In accordance with this theory, a novel paradigm devised by O'Donoghue, Broschard, Freeman, and Wasserman (2021) demonstrated that both humans and pigeons can learn complex, nonlinear category structures, and that they can extend their learning to untrained exemplars; however, humans appeared to begin learning by testing declarative rules, while pigeons exclusively used associative learning mechanisms. Here, we modified O'Donoghue et al.'s (2021) task to create an even more difficult paradigm that we expected to thwart declarative rule use, allowing us to further analyze the impressive power of the pigeons' categorization mechanisms. We also used

computational modeling to investigate whether a purely associative learning mechanism can effectively capture pigeons' categorization performance.

57 - John Kamp

Majors: Political Science | History

Mentor: Dr. Landon Storrs (History)

"It Ought to Be Possible": The Kennedy Administration, Black Radicalism, and the Civil Rights Movement, 1963

In the first years of his presidency, President Kennedy did not express a deep commitment to furthering the cause for civil rights. Rather, the Administration often took steps to de-escalate race relations rather than champion Black rights. However, by June of 1963, President Kennedy announced his support for civil rights legislation that would later become the Civil Rights Act of 1964. This thesis will examine the role that a fiery meeting in May of 1963 between Attorney General Robert Kennedy and author James Baldwin had on moving the Kennedy administration to support civil rights legislation and federal involvement. Already alarmed about the growing popularity of militant Black radicalism of Black youth, the May 1963 meeting prompted the Kennedy Administration to act to avoid further alienation of Black citizens. Further, it aims to recognize the impacts of radical Black activism on the federal government and civil rights protections of Black Americans.

This thesis also seeks to challenge the contemporary popular notions about the Kennedy administration's fervent role in furthering civil rights, as well as acknowledging the role the federal government has played, ranging from laissez-faire to obstructionist, regarding the Civil Rights Movement and the greater American Black Freedom Struggle.

59 - Hanna Konavaluk

Major: Geoscience

Mentors: Drs. Kenny Horkley, Emily Finzel (Earth & Environmental Science)

Comparison between geochronologic and geochemical provenance models for Cretaceous sedimentary rocks in Southwestern Montana

This research is investigating the regional tectonic evolution and sediment source areas of Cretaceous clastic rocks in southwestern Montana. This research compares the major and trace element geochemistry of the Cretaceous mudstone and sandstone samples from southwestern Montana with existing detrital zircon U-Pb geochronology. This comparison allows for conclusions to be drawn concerning the provenance models for this area. This geochemical approach is being used because some source rocks have minimal zircons which can limit our understanding of source areas and tectonic evolution. Existing detrital zircon U-Pb data suggest that both the Valanginian-Aptian Kootenai Formation and the Albian Blackleaf Formation demonstrate an up-section

change from primarily recycling of older sedimentary rocks to increased input from igneous rocks. Geochemical analysis of sedimentary samples from these areas allows for the evaluation of these up-section changes in provenance from predominantly recycled to recycled and arc and then back to a recycled provenance. This research will give insight into the source areas of the sediments, provide a more comprehensive provenance model, and give a broad sense of the regional tectonic evolution of southwestern Montana during the Cretaceous.

61 - Hannah McCumber

Major: Biology

Tracking Bacterial Colonization In Association With The F508del Cystic Fibrosis Mutation

The F508del mutation is the most common mutation within Cystic Fibrosis patients. 80% of patients possess this mutation. F508del causes a deletion in one of the amino acids constructing the CFTR protein. This mutation renders the chloride channel ineffective since the protein cannot fold into the correct shape for this function. This causes mucus to build in the lungs with no filtration from the CFTR protein. This creates an ideal breeding ground for bacteria which contributes to the leading cause of death in Cystic Fibrosis, lung disease.

The drug VX-770 (known commercially as ivacaftor) is a current FDA approved medication to aid in the treatment of cystic fibrosis. The drug has proven to have therapeutic effects for Cystic Fibrosis patients. Ferrets and pigs are effective models for Cystic Fibrosis because they closely model human organs compared to other animals like rabbits or mice. For this reason, Ferrets are used in the following experiments. Ferrets with the F508del mutation will show resistance to bacterial infection while on the VX-770 medication. When taken off VX-770 the progression of disease and colonization within F508del ferrets can be observed and compared.

F508del ferrets have shown significantly higher bacterial colonization than WT ferrets with both Aerobic and Anaerobic bacteria species.

63 - Abby Morrison

Major: Biochemistry

Mentor: Dr. Miles Pufall (Biochemistry & Molecular Biology)

Measuring Differences in the Glucocorticoid Receptor's Interactome Using APEX2

Leukemia and endometrial cancer are both treated with steroids, specifically glucocorticoids and progestins. Each works by a similar mechanism. Steroid hormones bind ligand-activated transcription factors called Steroid Hormone Receptors (SHRs). Upon binding, SHRs are activated, translocate from the

cytoplasm to the nucleus, and directly regulate genes that induce cell death in leukemia and arrest growth and induce differentiation in endometrial cancer. We are interested in how drugs used in combination with glucocorticoids and how different progestins change how their cognate SHRs function. Here we probe how these different treatments change the interactions of these SHRs with other proteins (interactomes). To do this I attached an engineered ascorbate peroxidase (APEX2) to the steroid hormone receptor, which enables covalent attachment of biotin to proteins in the proximity, including proteins that are even transiently bound to SHRs. In the case of leukemia, we will use this tool to understand how idelalisib enhances glucocorticoid-induced cell death by examining differences in what interacts with the glucocorticoid receptor. In endometrial cancer I will study how different progestins change the interactome of the progesterone receptor

65 - Jack Motz

Majors: English | History

Mentor: Dr. Tyler Priest (History)

"Rudy Thinks He's Batman": Koch, Giuliani, and Dinkins in the 1989 Race for Mayor

The research covers the 1989 New York mayoral election between Ed Koch, Rudy Giuliani, and David Dinkins. It looks into the strategies and images that each of the candidates used in order to run for mayor.

67 - Sophia Nopoulos

Major: Biology

Mentor: Dr. Jordan Schultz (Psychiatry)

Defining Clinical Progression of Juvenile-Onset Huntington's Disease: An Enroll-HD Analysis

Huntington's disease is defined as having an extended CAG trinucleotide repeat in one's genome. Patients with juvenile-onset (JOHD) have a unique, hypokinetic motor presentation compared to patients with adult-onset HD (AOHD) who present with hyperkinetic symptoms. Patients with AOHD sometimes experience hypokinetic symptoms in the late stages of the disease. Therefore, it is unclear if the unique phenotype seen in JOHD is caused by novel pathologic mechanisms or if these patients reach a hypokinetic stage much earlier in the disease. We leveraged the Enroll-HD database to compare motor patterns of JOHD to patients with AOHD and early-onset HD (EOHD). Patients with HD were split into those with JOHD (CAG ≥ 60 and age of motor onset (AMO) ≤ 21 years), EOHD (CAG ≥ 45 and AMO between 21 and 30), or AOHD (CAG ≤ 45 and AMO ≥ 30). Non-linear mixed effect regression models were utilized to compare the trajectory of UHDRS motor symptoms. Chorea decreased over time in the JOHD group while hypokinetic symptoms increased at a significantly faster rate compared to the EOHD and AOHD groups. The unique motor symptoms in JOHD most likely are not the result of novel neuropathologic mechanisms;

rather, they likely represent the accelerated trajectory of motor symptoms that start hyperkinetic and then progress to hypokinetic.

69 - Rachel Orpano

Major: Biochemistry

Mentor: Dr. Chi-Lien Cheng (Biology), Chris Youngstrom (Biology)

*Hormonal control of stem cell initiation in the fern *Ceratopteris richardii*.*

In plants, stem cells are the source of new organs and are regulated by genetic and hormonal factors. New stem cells arise if previous stem cells are damaged. In the fern *Ceratopteris richardii*, a single stem cell of the haploid gametophyte are housed in the lateral meristem, which produces new tissues and organs. This study investigates the mechanism at which new stem cells are initiated after the original stem cell is damaged. After laser ablation of *C.richardii* stem cells, a new lateral meristem is determined at an average distance of 140.3 μm from the ablated stem cell. Previous studies suggest the plant hormone auxin is the regulator of stem cell initiation, our results show that once the hypothetical auxin gradient is disturbed, new stem cells are initiated. Currently, we are evaluating how auxin synthesis and transporter genes are involved in meristem determination. These results suggest the hypothetical auxin gradient in stem cell initiation is an ancient process maintained over evolutionary time.

71 - Benjamin Pappas

Major: Biomedical Sciences

Mentor: Dr. Thorsten Maretzky (Internal Medicine)

The role of iRhom2-dependent signaling pathways in colorectal cancers

Patients with inflammatory bowel disease (IBD), such as ulcerative colitis or Crohn's disease, commonly develop chronic inflammation of the lamina propria and show disruption of the mucosal architecture of the large intestine with an increased risk of developing colitis-associated colorectal cancer (CAC). Tumor necrosis factor (TNF) and epidermal growth factor receptor (EGFR) signaling cascades are important for constant renewal and proliferation of the intestinal epithelium, which promotes proper barrier function, but when dysregulated can function as drivers in CAC. A disintegrin and metalloprotease (ADAM)17 is essential for the proteolytic release of active TNF and EGF family ligands. In addition, ADAM17 has been implicated in the development of colorectal cancer. Recently, the inactive rhomboid homolog 2 (iRhom2) protein has been identified as a crucial regulator for ADAM17 maturation and function. Interestingly, previous studies have shown that loss of iRhom2 expression results in an early onset of IBD. Furthermore, our unpublished data suggest that iRhom2 deficiency also leads to colorectal dysplasia, an important determinant

for the future development of CRC in IBD. Here we hypothesize that loss of iRhom2-dependent signaling pathways promotes the onset and progression of CAC. In the current study, we crossed *iRhom2* ^{-/-} animals with mice carrying a mutant allele of the murine Apc (adenomatous polyposis coli) locus to further evaluate the development of intestinal adenoma formation. We also assessed missense/nonsynonymous iRhom2 variants in the human genome and identified potentially pathogenic iRhom2 mutations in CAC.

73 - Katherine Pauley

Major: Nursing

Mentor: Dr. Catherine Cherwin (Nursing)

Exploring the Efficacy of Inhalation Aromatherapy in the Oncology Population: A Narrative Review

Purpose. This narrative review explores aromatherapy as a non-pharmacological addition to traditional pharmacotherapy to treat unresolved symptoms experienced by cancer patients. Inhalation aromatherapy works by stimulating olfactory receptors in the nose, sending messages to the limbic system that promotes relaxation as well as other health benefits (Blackburn et al., 2021).

METHODS. PubMed was searched using the terms cancer/oncology, inhaled aromatherapy, essential oils, lavender, peppermint oil, ginger, symptoms, nausea, sleep, and anxiety. Articles were included if they were published in a peer-reviewed journal in English language. Participants must be oncology patients receiving active cancer treatment, reporting at least one treatment-related symptom, and receiving an aromatherapy intervention.

RESULTS. The initial search retrieved 66 articles, of which 17 met our inclusion criteria and were included in this review of literature. Results demonstrated that the addition of inhaled aromatherapy to standard cancer care can significantly reduce nausea, vomiting, sleep disruption, and anxiety in people with cancer. Participants reported enjoying the intervention even if it did not significantly improve their symptoms and minimal adverse events were recorded.

CONCLUSION. Aromatherapy could prove to be a cost-effective patient-led intervention for cancer patients. It can allow for lessened symptoms without the addition of more pharmacological measures.

75 - Cade Rahlf

Major: Biochemistry

Mentor: Dr. Madeline Shea (Biochemistry & Molecular Biology)

Calmodulin Binds Conserved Motifs in Fibroblast Growth Factor Homologous Factors

Voltage-gated sodium channels (Navs) are tightly regulated by multiple proteins including calmodulin (CaM), a calcium-signaling protein, and fibroblast growth factor homologous factors (FGFs). We discovered that two sequences in the N-terminal domain (NTD) of A-type FGFs (FGF11A, FGF12A, FGF13A, and FGF14A)

bind both domains of calcium-saturated CaM. These FGF sites (LTP, long-term inactivation particle, and CaMBD, CaM-binding domain) possess a high degree of evolutionary conservation in eukaryotes. Computational analysis and modeling predicts these sites adopt helical secondary structures within a larger intrinsically disordered region. We hypothesize that CaM binding to the CaMBD, the higher affinity site, facilitates movement of LTP towards the pore, resulting in long-term inactivation. To visualize possible states of this 3-protein complex, we are using structural and hydrodynamic studies. To understand calcium-induced switching in this allosteric network, we are conducting titrations monitored by steady-state fluorescence spectroscopy to determine differences in effects of A-type FGFs on CaM bound at NaV1.2, and CaM bound to the FGF NTD. These titrations suggest that A-type FGFs can compete with NaV for Ca²⁺-saturated CaM. During an action potential, CaM may translocate from the NaV to the FGF NTD or the FGF NTD may recruit a second molecule of CaM to the channel.

77 - Olivia Rauzi

Major: Finance

Mentor: Dr. Catherine Zaharis (Finance)

Retirement in the United States: Gender Gap, Covid-19 Impacts, and Solutions to Accumulate More Wealth

My research has been about the state of retirement in the US. I have also been researching the gender gap in retirement savings, how women are saving much less than men, and the problems associated with this gap. The Covid-19 pandemic has not only worsened the state of American retirement, but it has also widened the gender gap. Finally, I have researched millennials' lack of preparedness for retirement compared to earlier cohorts and the reasons for this issue.

79 - Ana Rodriguez

Major: Interdepartmental Studies

Mentors: Dr. Max Lei Geng, Hong Bok Lee (Chemistry)

Simulating Molecular Diffusion in Separation Science

Chemical separations are a central technique in science, technology and medicine that comprise 10-15% of energy consumption in the United States. In the 2019 report "A Research Agenda for Transforming Separation Science", the National Academies of Science, Engineering and Medicine outlined future research to improve separation science. Molecular diffusion is the key mechanism controlling separation efficiency and central to understanding separations. Our goal is to directly image molecular diffusion in separations for the first time.

In this research project, we theoretically simulated molecular diffusion with Monte Carlo simulation in a range of solvents of varying viscosities. Theoretical

simulations would guide the development of fluorescence correlation measurement of molecular diffusion in chemical separations. Programs coded in MATLAB provided the theoretical simulations. Photon counting data from simulations was evaluated to calculate the correlation function. The correlation curves were then fitted to three-dimensional diffusion models using nonlinear least squares (NLLS) in Origin to extract diffusion coefficients. Calculations demonstrated molecular diffusion can be accurately measured with fluorescence correlation spectroscopy under a range of separation conditions. Simulations highlighted fast time resolution and high frequency photon counting as essential for the measurements. Our experiment can direct experiments where determining diffusion coefficients is critical.

81 - Grant Salvucci

Major: Biology

Mentor: Dr. John Manak (Biology)

Investigating genetic interactions between genes encoding the Myb oncoprotein and key repressive chromatin and insulator binding proteins.

Genes in the genome are organized into active and repressed regions of chromatin, which is made up of DNA and associated proteins. More recently, these chromatin "neighborhoods" have been shown to be contained in Topologically Associating Domains (TADs) that often organize into loops. How these TADs are established and maintained is largely unknown at this point. Our laboratory has previously found that the transcriptional regulator Myb binds to TAD boundaries (also known as insulators), and in its absence, Polycomb-associated repressive chromatin neighborhoods are destabilized thus leading to inappropriate upregulation of genes within them. For these reasons, we hypothesize that Myb protein might be required to tether TAD boundaries together in concert with other insulator-binding proteins to stabilize repressed regions of the genome. This project's goal is to determine whether the Myb gene in the *Drosophila melanogaster* genetically interacts with genes encoding the insulator-binding protein CTCF and/or repressive chromatin-associated protein Polycomb (Pc). Such interactions would help define proteins that work together to maintain repressive TADs. Notably, all three genes are conserved up to humans, and alteration of Myb genes has been associated with a variety of human cancers. Knowing if these genes interact may identify additional components driving Myb-associated cancers.

83 - Sushma Santhana

Major: Biomedical Engineering

Mentor: Dr. Donald Anderson (Orthopedics & Rehabilitation)

Measuring Tunnel Placement in ACL Reconstruction from Weight Bearing CT

The recent introduction of low-dose weight bearing CT (WBCT) has enabled safe and cost-effective 3D evaluation of loaded knee joints. Surface data reflecting the

shape and location of bones are routinely extracted from WBCT data in the UI Orthopedic Biomechanics Laboratories. Following surgery to reconstruct a ruptured anterior cruciate ligament (ACL), the tunnels created in the bone for the ACL graft placement can be clearly visualized. Accurate tunnel placement is an important determining factor for success in this reconstructive operation. Researchers in the Department of Orthopedics and Rehabilitation previously developed a computational analysis tool to extract ACL tunnel placement from conventional CT images (Ramme et al. *Comput Aided Surg.* 2012. 17(5):221-31.). These existing methods have been adapted/updated using MATLAB and Geomagic Design X to perform the measurements on WBCT. This capability enables the conduct of studies to determine the influence of ACL tunnel placement on clinical outcomes and subsequent risk of post-traumatic osteoarthritis. The new methods have been utilized to characterize tunnel placement in a series of 4 knees with WBCT data available. The orientation of the tunnels were obtained with respect to local reference frames defined on the tibias/femurs in a standardized procedure.

85 - Sophia Shubatt

Majors: Criminology, Law, & Justice | Political Science

Mentor: Dr. Stephanie DiPietro (Sociology and Criminology)

Best Practices for Teaching Higher Education in Iowa Prisons

Review of relevant literature supplemented with data from interviews with professors who teach courses for incarcerated individuals in a prison setting

87 - Jack Smith

Majors: Neuroscience | Biochemistry

Mentor: Dr. Tori Forbes, Samantha Kruse (Chemistry)

Cosolvent Effects on Crystallization of Novel Uranium Dimer

Metal organic nanotubes (MONTs) are unique because they allow for tuning of both hydrophobic and hydrophilic regions within the nanotube. Previous research done in the Forbes group reported the formation of MONTs made out of uranium (UMONs) and iminodiacetate (IDA), which afford chemical selectivity to water. These UMONs are formed in aqueous solution where the geometrically linear uranyl cation (UO_2^{2+}) can bond in its equatorial plane to a variety of organic linkers which chelate and bridge these cations into these porous channels. The properties of water under nanoconfinement differ from bulk solution, making it important to study these UMONs so we can design new materials for water storage and purification. In this study, we report a disruption in the formation of a UMON and the hydrogen bonding network leading to solvent ordering within them through the replacement of iminodiacetate with a structurally similar organic ligand. We found that iminodiacetate most favorably reacted with UO_2^{2+} in a mixed ligand system; however, without iminodiacetate in solution, n-methyl-iminodiacetate would chelate equatorially to two UO_2^{2+}

bridged by hydroxyl groups. Furthermore, we report the presence of different organic cosolvents changed the packing of these chelated uranyl dimers into varying crystal lattices upon evaporation.

91 - Michael Toops

Major: Chemical & Biochemical Engineering

Mentor: Dr. Eric Nuxoll (Chemical & Biochemical Engineering)

Pseudomonas aeruginosa biofilm sterilizing on Thermoelectric Devices

Constructing experimental conditions to disinfect biofilms of *Pseudomonas aeruginosa* through a heat shock at different temperatures and lengths of time with a thermoelectric device to align results with immersion heating trials.

93 - Emerson Tran Lam

Major: Chemistry

Mentor: Dr. Christian Haas (Chemistry)

Potential Electrochemical Applications in Green Chemistry

Running chemical reactions and treating chemical waste is expensive, resource intensive, and accounts for a large proportion of total energy consumed worldwide. Our data indicate magnetic field gradients near the electrode's surface may optimize chemical reactions and better achieve Green Chemistry principles by increasing reaction rates. This faster rate reduces the number of side products and lowers energy consumption of the reaction. These fields were generated via magnetic composites in Nafion and have been shown to increase certain reaction rates by a factor of approximately 10 compared to Nafion controls. Selective reductant electrowinning (SRE) also advances Green Chemistry principles by reducing heavy metal concentrations in aqueous and organic waste solutions. This method is similar to traditional electrowinning but focuses on optimizing small scale procedures for the laboratory setting. Our SRE setup may further reduce cost of experiments by recovering expensive metal catalysts such as palladium and platinum from waste solutions. Energy consumption is also lower compared to traditional electrowinning via the use of a sacrificial reductant, or a chemical species that helps remove the metal at a lower electrical potential. The electrowinning project was originally proposed by Graduate RA Christian Haas for his comprehensive exam.

95 - Cally Tucker; Joshua Peterson

Majors: Neuroscience | Biochemistry; Biology | Biochemistry

Mentor: Dr. Marcelo Correia (Internal Medicine)

Mice with DRP1 Depletion in Skeletal Muscle are Resistant to Age-related Weight Gain Associated with Activation of Endoplasmic Reticulum-dependent Stress Response.

Dynamin Related Protein-1 (DRP1) is responsible for mitochondrial membrane constriction during fission. Notably, skeletal muscles of type 2 diabetics exhibit mitochondrial dysfunction associated with increased mitochondrial fragmentation and increased activity of DRP1. Our aim was to explore the metabolic phenotype of aging mice (80 weeks-old) with skeletal muscle-specific DRP1 deficiency (KO mice) as compared with wild type control mice (WT mice). DRP1 deficiency in male and female aging mice resulted in a reduction in total and fat mass. Male DRP1 KO aging mice also exhibited elevated fasting plasma FGF21 and GDF15, and reduced insulin but no changes in glucose tolerance test (GTT), insulin tolerance test (ITT), or energy expenditure as compared to WT mice. Male DRP1 KO aging mice showed reduced grip strength of forelimbs but no changes on distance walked on treadmill. We did not observe changes in O₂ consumption in isolated skeletal muscle fibers from male KO aging mice in response to diverse substrates. Male KO mice also exhibited no change in the expression of UCP1 in brown adipose tissue or white adipose tissue, as well as no difference in protein expression in white adipose tissue. In conclusion, our study shows that the depletion of DRP1 in skeletal muscle in aging C57 mice is associated with increases in plasma FGF21 and GDF15 suggesting activation of endoplasmic reticulum stress response, which could explain resistance to fat accumulation associated with aging.

97 - Zach Vig

Majors: Physics | Geology

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

Using a Camsizer to improve grain-size based Hydraulic Conductivity Estimates

Characterization of groundwater flow in ice-marginal environments is an exceedingly difficult task when using conventional sieve analysis. The aim of our work is to utilize Camsizer technology to improve both the accuracy and efficiency of grain-sized based hydraulic conductivity measurements in order to better characterize contaminant flow in these sediments. By analyzing the sand fraction of several down-hole sediment samples, we have shown that there may be some efficacy to these methods, although further analysis of fine-grained material is needed to make concrete estimates of subsurface plume movement for our site and similar ice marginal environments.

99 - Rachael Volkman

Major: Neuroscience

Mentor: Dr. Kumar Narayanan (Neurology)

Characterizing the role of indirect-projecting D1-MSNs in movement and interval timing

The external segment of the globus pallidus (GPe) is a critical component of the motor suppressive "indirect" pathway of the basal ganglia. The majority of striatal medium spiny neurons (MSNs) which innervate the GPe express the inhibitory D2-dopamine receptor, allowing for dopamine-gating of movement. Recent work has demonstrated that GPe neurons also receive input from MSNs which express the excitatory D1-dopamine receptor, a cell population

traditionally associated with the movement-promoting “direct” pathway. However, the role of indirect projecting D1-MSNs in behavior remains poorly understood. Here, we characterized the anatomical distribution of D1-MSN projections to the GPe utilizing anterograde tracing in transgenic D1-cre mice. Then, we interrogated the role of this circuit in movement and interval timing utilizing cell-type specific optogenetics. We report that selective optogenetic inhibition of D1-MSN terminals in the GPe results in impaired motor kinematics and temporal accuracy. Taken together, these data suggest that indirect-projecting D1-MSNs may play a critical role in the regulation of striatum-dependent behaviors, expanding classical models of basal ganglia physiology.

101 - Matthew Wells

Major: Human Physiology

Mentor: Dr. Shujie Yang (Pathology)

SETDB1 Promotes Tumor Growth Through Suppression of Macrophage Infiltration Into the Tumor Microenvironment

Endometrial cancer (EC) is the most common gynecological cancer, with around 63,000 new cases per year. Survival rates in individuals with EC have decreased from 87% in the 1970s, to 81% in recent times. SETDB1 has been identified as an oncogene in various cancer types, including EC. SETDB1 is an H3K9 methyltransferase involved in gene suppression, affecting tumor suppressors p53 and p21 in endometrial cancer. SETDB1 has been linked to tumor progression in other cancers, such as lung, colorectal, melanoma, and pancreatic. Alongside SETDB1, protein KAP-1 aids SETDB1 in HP1-mediated silencing of euchromatic genes. The purpose of this study was to observe the mechanistic implications of SETDB1 in EC. 5 million endometrial cancer cell line Ishikawa (ISH) cells were injected subcutaneously into two groups of MSG immunocompromised mice. One group was injected with NT1 (wild type) cells, and the other group was injected with SETDB1 knockout (ko) cells. The allowed growth period for the tumors was 48 days from the injection date. Both groups of mice were sacrificed at one single time point. Tumors were sectioned for F480 staining and minced for collagenase digestion. Flow cytometry was conducted on tumor samples as well as spleen samples to provide insight into systemic macrophage recruitment.

103 - Amisha Mohanty; Isabel Meade; Allen Li; Maryam Mohammed

Majors: International Relations | Economics ; Political Science; Business; International Relations

Mentor: Brian Lai (Political Science)

Foreign Policy - The Effective Use of Force in Human Rights Interventions

Our research categorically arranged and analysed patterns in historical events/cases where the use of force was or was not effective as a form of intervention. We looked at three case studies in particular: Somalia, Haiti, and Kosovo. One of our conclusions/findings showed that post-1945 era, the U.S. has been able to achieve its political objectives, especially when it applies substantial numbers of ground forces.

5:30-6:30 Presenters (even numbers only)

2 - Kesten Anderson

Major: Neuroscience

Mentor: Dr. Kanchna Ramchandran (Internal Medicine)

Training and Certification in Transcranial Magnetic Stimulation

Transcranial Magnetic Stimulation (TMS) is a noninvasive procedure that uses a high-intensity magnetic field to modulate neuronal activity in specific brain regions. Training in TMS was a multifaceted process that started with acquiring motor thresholds, a process of determining the lowest level of stimulation required to obtain a motor response. This process was paired with Brainsight, a neuronavigation software using a structural scan of the patient, to isolate brain regions of interest (ROI's). We were then able to target an ROI, as well as mark the trajectory the coil will take to reach it, alternating between three coils in the excitation of two ROI's. The trajectory was created by aligning an entry point in the scalp with the target on the ROI. After locating the trajectory, depth adjustments were made for each ROI to account for the cortical distance to the target. The training incorporated a sham treatment to account for a potential placebo effect on cognitive functioning. In our sham treatment, we go through the TMS processes without administering treatment and instead give false treatment using electrodes to mimic the sensation of TMS. The true treatment is a custom developed dosage in the intermittent Theta-Burst Transcranial Magnetic Stimulation (iTBS) format.

4 - Laxmi Annapureddy; Emily Severino

Majors: Neuroscience | Journalism & Mass Communication; Psychology | Criminology, Law, & Justice

Mentor: Dr. Ece Demir-Lira (Psychological & Brain Sciences)

The Role of Parental Input and Dialogue in Children's Number Processing Development: A Behavioral Study

Noam Chomsky proved there is an ideal age for language acquisition. Similarly, there is evidence to suggest that math learning abilities may follow a similar pattern. There is an ideal time and type of interaction that facilitates math learning: childhood math interactions with a parent. A recent meta-analysis conducted by Daucourt and co. (2021) has shown early positive approaches to math in a child's home math environment (HME) may be correlated with future math abilities.

Our study was conducted from Oct 2020 - Mar 2021. We invited 72 parent-child dyads to the Development, Experience, and Neurocognition Lab at the

University of Iowa to participate in a one hour online session conducted via Zoom. The intent of this study is to further investigate the Daucourt findings and determine whether specific types of conversational math learning in a child's HME are correlated with distinct math abilities.

We hypothesize that the type and quality of HME conversations correlate with three major types of later math abilities: symbolic, matching, and non-symbolic, and that verbal conversation functions to predict over and above parental actions/activities.

Results and analyses are currently in progress. With this study, we hope to provide insight into the processes that elevate children's math ability, and address inequalities in young children's school experiences.

6 - Shalini Birari

Major: Microbiology

Mentor: Dr. Mary Wilson (Microbiology & Immunology)

Tracking the dissemination of Leishmania Infantum in mice

Leishmania infantum (L.i) is a parasite that gives rise to visceral leishmaniasis (VL), the most severe form of disease caused by this parasite. VL disproportionately affects rural and low-income populations in tropical nations. Despite major underreporting, the documented disease burden is high. VL is spread through a sand fly bite to become a chronic, systemic disease resembling leukemia that is usually fatal if untreated. Our understanding of how the parasite disseminates throughout the host is poor. We hypothesized that the type of cell facilitating the initial spread of parasites from skin to the local draining lymph nodes is critical to the long-term outcome of infection. We examined this hypothesis by investigating the specific cells mediating L.i dissemination of VL using transfected L.i that express fluorescent markers. We studied the kinetics, and the parasite virulence and host immune factors that determine how the parasite spreads. Our studies involved infection of mice with either wild type or genetically manipulated L.i. We tracked luminescent, fluorescent parasites using sensitive in vivo imaging techniques in live mice, flow cytometry, and in vitro assays of cellular immune responses.

8 - Daniel Bloch

Major: Environmental Hydroscience

Mentor: Dr. Phil Kerr (Earth & Environmental Science)

Eastern Iowa Dune Orientation as a Proxy for Effective Wind-Direction During the Late-Wisconsinan

The orientation of dunes in Eastern Iowa demonstrates the effective wind direction during the Late Wisconsinan. The study area contains over 2,100 dune features mapped from 1m LiDAR-derived rasters and SSURGO-based parent materials. The highest concentration was found on the lowan Erosion Surface (IES). This project derived the wind direction of nearly 700 parabolic dunes using

their arm orientation. The resulting dataset showed a Gaussian distribution with a mean around 300 degrees (WNW). This unimodal signal indicates that there was one effective wind direction (WNW) across multiple landform regions during the active phase of dune formation. These findings support previous research indicating a WNW wind during the Late Wisconsin in the Midwest and strengthen the transport surface interpretation of the IES.

10 - Nicole Boodhoo

Major: Biomedical Sciences

Mentor: Dr. Gordon Buchanan (Neurology)

The role of the 5-HT_{2c} receptor on breathing and mortality following an induced seizure in amygdala kindled mice: the possible role of corticosterone

Epilepsy affects 65 million people worldwide. One-third of these patients will not experience seizure control with medication and are at high risk of dying from sudden unexpected death in epilepsy (SUDEP). Seizures are thought to impair serotonin (5-HT) signaling and breathing to contribute to SUDEP. While attempting to study serotonergic mechanisms underlying seizure-induced respiratory arrest, our lab found that when wild type mice received the 5-HT_{2C} receptor agonist, MK-212, they died following a seizure. This was surprising. To evaluate the receptor specificity of this effect we gave MK-212 to 5-HT_{2C} knockout mice, and found that these mice also died following seizures, suggesting an off-target effect of MK-212. We hypothesize that the increased seizure-related death with MK-212 is due to increase in corticosterone and that blocking corticosterone receptors will prevent MK-212-induced death. We induced seizures with amygdala stimulation in amygdala kindled mice following treatments with either corticosterone antagonist or vehicle. Following injection of either treatment, animals received injection of 30 mg/kg MK-212. We measured EEG, breathing, and survival. We expected to see reduced death with corticosterone antagonist/MK-212 and increased death with vehicle/MK-212. Thus, we expected to establish a role for corticosterone in SUDEP.

12 - Christian Brandt

Major: Biochemistry

Mentor: Dr. Shelia Baker (Biochemistry & Molecular Biology)

Computational Analysis of Mutation In Kv8.2

Within my lab I've been prioritizing learning while also working some research into it. Over the summer I worked on several different protocols all related to the cloning of the Kv8.2 expression gene with the Kv2.1 gene. The end goal is to be able to analyze individual mutations in Kv8.2 and compare them to the qualitative data I acquired last school year using a program called pyMol. The

idea is to test each mutation in Kv8.2, which has been linked to cone-rod dystrophy, based on the ones in which my computational analysis found to be suspects for the failure of function in the potassium ion tetramer between kv2.1 and kv8.2.

14 - Brianna Brennecke

Major: Biomedical Engineering

Mentor: Dr. Yumi Imai (Internal Medicine)

Establishment of the functional monolayer of human pancreatic beta cells as a model to study interactions of intracellular organelles

Type 1 and type 2 diabetes result from pancreatic beta-cell failure due to an immune response or overnutrition. As malfunction of multiple intracellular organelles is reported in diabetic beta cells, morphological assessment of these organelles is important to understand pathogenesis of beta cell failure. Our goal is to determine type of collagen best suited for the formation of beta-cell monolayer that is apt for high-resolution imaging while maintaining beta-cell differentiation. We chose type IV and V collagens as two representative collagens with distinct structure based on previous data. Human islet cells from non-diabetic donors were dispersed into a single cell suspension and seeded at a density of 2.6×10^3 cells/mm² on glass coated with 50 mcg/ml of collagen. Fixed cells were stained for Insulin/Glucagon and analyzed using confocal microscopy showing X/X cells stacking for collagen V and collagen IV respectively. Thus, collagen V generally allows for a more uniform monolayer of pancreatic beta cells when compared to collagen IV. Both collagens showed similar and robust glucose-stimulated insulin secretion (stimulation index, 4.2 for collagen IV and 4.1 for collagen V, n=6). Collectively, collagen V provides appropriate coating for beta cells that are amenable for imaging while preserving function.

16 - Benjamin Colbert

Major: Human Physiology

Mentor: Dr. Laura Frey-Law (Physical Therapy & Rehabilitation Sciences)

Analyzing Correlations between Self-Report and Accelerometer-based Physical Activity Assessment Across Activity Levels

Numerous studies report significant, but relatively weak, correlations between self-report and accelerometer-based assessments of physical activity (PA). Typically, low associations are attributed to self-report error, assuming accelerometer data is the gold standard. However, our laboratory previously showed high variability in accelerometer data between processing algorithms with often low correlations between objective PA outcomes (Mueller et al, 2020), suggesting issues with measuring PA are not solely self-report. Most prior

studies between accelerometer and self-reported PA used cross-sectional analyses of 7-day recall, but within subject comparisons day-by-day are lacking. Thus, the purpose of this study was to evaluate self-report and accelerometry PA day-by-day, considering both with-in and between-subjects' comparisons. Our preliminary data (n=13) indicate sometimes large variations in correlations individual to individual, but the median correlation was nearly double values reported in most cross-sectional, week-long recall studies. The current study further advances these findings and better characterizes correlations between daily self-reported and accelerometer PA data. We are expanding to a larger population (approximately n = 60) to better characterize self-report vs objective PA relationship. In addition, we tested a new daily PA questionnaire, relative to a common 7-day instrument, and asked subjects to provide a subjective preference for both instruments.

18 - Kalynn Culver

Major: Biology

Mentor: Dr. Robert Cornell (Anatomy & Cell Biology)

TRPM7 and TYRP1 detoxify melanin-synthesis: a shared pathway involving zinc?

Forward genetic screens in zebrafish in the 1990s identified multiple alleles of a mutant, touchtone, in which embryonic melanocytes undergo cell death upon pigmentation. Additional phenotypes in touchtone mutants include abnormal kidney function leading to abnormal bone differentiation, and defective function of primary sensory neurons called Rohon-Beards. We mapped a member of this group to the *trpm7* gene which Transient Receptor Potential Melastatin 7. TRPM7 is an ion channel permeable to calcium, also magnesium and zinc; it also harbors a serine-threonine kinase in its carboxy terminus. It is present on the plasma membrane and on intracellular vesicles of unknown identity (not melanosomes). Its role in survival of melanocytes is unclear. Interestingly, inhibition of melanin synthesis prevents melanocyte cell death in *trpm7* mutants. This quality is shared in specific alleles of *tyrp1* mutants in mice and zebrafish, suggesting that *Trpm7* and *tyrp1* function in a shared pathway to prevent melanin-synthesis dependent cell death. We hypothesize that in the absence of TRPM7 is a zinc deficiency in melanocytes which inhibits the function of Tyrosinase-related protein 1a (*Tyrp1a*), a zinc dependent enzyme. To test this hypothesis, we are manipulating expression of genes encoding zinc importers and exporters expecting these manipulations will rescue melanocyte cell death and recover pigmentation in *trpm7* mutants. We have generated a hybrid *Tyrp1a* predicted to be copper-dependent

20 - Cole Dorman

Majors: Physics | Astronomy

Mentor: Dr. David Miles (Physics & Astronomy)

The Development of the MAGIC Magnetic Screening Apparatus

MAGIC is a magnetometer instrument for the TRACERS spacecraft that will take high precision measurements off the Sun's magnetic field. The measurements are subject to interference from the spacecraft so we estimate required noise levels and sensitivity based on TRACERS stray magnetic field requirements. Based on this, we developed an apparatus evaluating the current hardware for such requirements. We tested its performance using known magnetic sources and are developing a test plan to ensure it can be used reliably by engineering technicians to screen components while building subsystems for the TRACERS spacecraft. Based on preliminary results, we are finalizing the prototype and the testing procedure which will be released through configuration control.

22 - Joshua Doucette

Majors: Physics | Mathematics

Mentor: Dr. Usha Mallik (Physics & Astronomy)

Search for Dark Matter in mono-H(bb) channel with the ATLAS detector

The analysis of this study is based on the Two Higgs Doublet Model (2HDM), a Beyond Standard Model (BSM) theory, which is a part of the Higgs portal models. The 2HDM model predicts dark matter (DM) production in association with a Standard Model (SM) Higgs boson, known as the mono-H(bb) channel. The mono-H(bb) analysis targets final states with large missing transverse energy (MET) (due to the undetected DM particles), and two b-quarks from the Higgs decay. The data is binned into multiple MET regions to be sensitive to a wide range of mass choices of the benchmark models. This study compares significance between the current MET binning choice and different MET binning settings with the intention of optimizing the MET binnings used in the mono-H (bb) framework.

Data from Monte Carlo simulation must be compared to data taken from the ATLAS detector at the LHC. Thus to be complete, a presentation of the front-end electronics to be used in the new silicon based inner tracker for ATLAS will be shown in addition to the findings of this study. This study has not been performed before and indicates if the MET binning choices are optimized.

24 - Grace Drinane

Major: Human Physiology

Mentor: Dr. Donna Santillan (Obstetrics & Gynecology)

Blood pressure measurements in pregnant women comparison of the American Heart Association guidelines to inpatient clinical measurement

The accuracy of blood pressure measurement (BPM) is crucial to making the correct diagnosis and treatment of hypertensive disorders during pregnancy, a leading cause of maternal death and morbidity. The American Heart Association (AHA) released guidelines for proper position and patient preparation for BPM, including no eating for 30 minutes and seated comfortably with feet on floor for 5 minutes. However, a recent study demonstrated that not all guideline steps are consistently performed. Inaccurate BPM can lead to inaccurate diagnosis and over or under treatment which ultimately increases the risk to mother and babe.

Our study examined BPM following the AHA guidelines compared to the most recently performed clinical BPM on pregnant women on an inpatient study. Our results indicated a statistically significant difference in the diastolic BPM ($p=0.0810$). Additionally, when comparing AHA BPMs and clinical BPMs that were performed in seated positions, a statistically significant difference in systolic and diastolic BPM ($p=0.0016$ and $p=0.0006$, respectively) were demonstrated. Overall lower trends of BPM were noted in all analyses of AHA guidelines compared to clinical values.

This study demonstrates the importance of rigorous adherence to AHA guidelines in order to conduct proper BPM for increased accuracy in diagnostic and treatment practices.

26 - Bridget Easler

Major: Public Health

Mentor: Dr. Terry Wahls (Internal Medicine)

Obtaining Baseline Characteristics of Longitudinal Study Participants with Clinically Isolated Syndrome and Relapsing-Remitting Multiple Sclerosis

The Longitudinal Study of Clinically Isolated Syndrome and Relapsing-Remitting Multiple Sclerosis is a non-randomized quasi-experimental study. The aims are to prospectively assess the impact of a behavior and diet program on diet quality, fatigue, mood, quality of life, and disease course in participants with newly diagnosed (< 12 months) relapsing-remitting multiple sclerosis (RRMS) or clinically isolated (CIS) syndrome. Participants in the intervention arm who have previously voluntarily declined disease modifying drug treatments, are

trained on a modified Paleolithic diet, breathing mediation, and a walking program. The control arm will receive usual care from a MS specialist. This project aims to assess the baseline health and demographic characteristics of participants in the intervention and control arms. This was done by obtaining consent forms from screened and eligible participants and requesting and abstracting information from medical records from appointments that lead to the initial diagnosis. These medical records were requested from primary care doctors and neurologists. Baseline health and demographic characteristics are abstracted from MRI reports, Patient Lab Results, and Medical Progress Notes. This project aims to describe the process of abstracting information from these medical records and baseline characteristics of participants.

28 - Greg Eckley

Majors: Environmental Science | Spanish

Mentor: Dr. Matthew Dannenberg (Geographical & Sustainability Sciences)

Sensitivity of white oak growth to past climate variability in eastern and central Iowa

I examined the potential to better resolve monthly- to seasonal-scale climatic influences on tree growth by separately measuring the widths of tree-ring earlywood (formed during spring/early summer) and latewood (formed during summer/early autumn), which have visibly distinct anatomical structures. I tested this at 8 white oak (*Quercus alba*) sites in central and eastern Iowa. I examined the magnitude and seasonality of climatic influences on earlywood and latewood formation. I found that both earlywood and latewood widths responded positively to precipitation and negatively to vapor pressure deficit (VPD), indicating that *Q. alba* growth is generally water-limited across these sites, but the effects of climate were generally stronger on latewood growth than on earlywood growth. The seasonality of climate effects on growth also differed significantly between the earlywood and latewood. Earlywood widths were generally most sensitive to precipitation and VPD in the prior summer and autumn, while latewood widths were most strongly dependent on precipitation and VPD in the summer during the year of growth. Together, these results provide new information on how climate affects forest growth in eastern/central Iowa and can inform improved tree-ring reconstructions of past climate variability and change using separate earlywood and latewood measurements.

30 - Khalid Elhadi

Major: Health & Human Physiology

Effect of the Morphine Metabolite M3G on VEGF Protein Expression in SPARC-null Intervertebral Discs

In degenerated intervertebral discs (IVD), vascular endothelial growth factor

(VEGF) protein expression increases leading to vascularization which can contribute to low back pain. Opioids are the primary intervention for pain management, but may have possible detrimental effects. Our objective was to examine how VEGF protein expression changes in response to the morphine metabolite M3G, as well as a possible relationship between VEGF expression and the Toll-Like Receptor 4 (TLR4) pathway. M3G binds to TLR4 and activates the innate immune response. Lumbar IVDs of SPARC-null mice, which exhibit disc degeneration similar to humans, were dissected and placed in culture media with four different treatments, including: Vehicle, M3G, M3G + TAK-242, a TLR4 antagonist, and Lipopolysaccharide, a TLR4 agonist. VEGF protein expression was analyzed by ELISA. VEGF levels were higher in the SPARC-null IVDs compared to control discs and M3G had no effect on VEGF expression. TLR4 inhibition decreased VEGF expression in female SPARC-null mice compared to vehicle-treated mice. A possible limitation of our study is a small sample size. While VEGF expression was not altered by M3G, sex differences in VEGF concentration in response to TLR4 inhibition suggests that the mechanisms controlling VEGF expression may differ in males and females.

32 - Hanlong Fan

Major: Psychology

Mentor: Dr. Leyre Castro (Psychological & Brain Sciences)

Complex Rule Learning in Pigeons

Regularities in everyday life allow us to generate rules and provide structure to our environment. Pigeons learn about event regularities as well, but to what extent they learn rules or they learn to associate different elements with one another—an efficient, but more basic mechanism—is still an unresolved issue. Here, we aimed to teach 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). Critically, the task could be mastered by learning the rule, but also by associating the features with one another, and their combination with the response. After training with two sets that exemplified these rules, we trained the pigeons with incomplete sets; then, we tested the pigeons with the remaining combinations to see if their performance was based on rule learning or associative strategies. Training proved to be very difficult, but 6 out of 8 pigeons mastered the task. Testing revealed that none of the pigeons had inferred the rule; their responses were based on feature associative learning. Future experiments will examine the conditions to encourage pigeons' rule learning.

34 - Hope Fury

Major: Biomedical Sciences

Mentor: Dr. M Nedim Ince (Internal Medicine)

Regulatory T Cells Require the Transcription Factor GATA3 for Optimal Suppression of Graft-versus-Host Disease

Regulatory T cells (Tregs) are critical for the suppression of graft-versus-host disease (GVHD) after bone marrow transplantation (BMT). Previously, we have shown that helminth-conditioned mice regulate GVHD by increasing the activity of Tregs in a TGF- β -dependent manner. Helminth conditioning also increases the expression of GATA3 in Tregs. GATA3 is a transcription factor critical to T helper-2 differentiation. Here we investigated the role of GATA3 in Treg-mediated regulation of GVHD. In an add-back model of splenic GATA3-sufficient or GATA3-deficient Tregs into BALB/c BMT recipient mice from C57BL/6 donors, adoptive transfer of GATA3-deficient donor Tregs led to a more severe GVHD disease phenotype and increased mortality compared to adoptive transfer of GATA3-sufficient donor Tregs. Moreover, GATA3 was required for Tregs to produce TGF- β , which is critical to Treg expansion and function. Helminth conditioning was essential in showing the GATA3-dependent production of TGF- β in Tregs. Overall, these results provide evidence for the critical role of GATA3 expression in Tregs to generate immune regulatory TGF- β and suppress GVHD.

36 - Alexandra Gilchrist

Major: Accounting

Mentor: Dr. Andrew Hosmanek (Management & Entrepreneurship)

Consequences of Pay for Play

I am researching the new name, image, and likeness laws. With recent changes within college athletics, I am specifically looking at the Booker and Blumenthal Bill in which athletes would be paid by the universities through a share of the revenue in profitable sports. As the current financial model of collegiate athletes is one where profitable sports pay for all others, this new law would have far reaching consequences. I am arguing pay for play and specifically revenue sharing should not be a part of college athletics as inequity would result. Particularly women and small sports would be significantly hurt. I further outline recommendations instead.

38 - Megan Grunst

Major: Biomedical Engineering

Mentor: Dr. Jason Wilken (Physical Therapy & Rehabilitation Sciences)

Carbon Fiber Ankle Foot Orthoses in Individuals with Impairments: A Systematic Review

Ankle foot orthoses (AFOs) are commonly used to reduce pain and improve function. Carbon fiber dynamic orthosis (CDOs) are a widely used type of AFO. The purpose of this systematic review was to determine if carbon fiber ankle foot orthoses can improve outcomes compared to no orthosis or other orthosis types in individuals with a foot or ankle impairment or pain. Multiple databases were searched to identify relevant articles. The results were then deduplicated and the inclusion and exclusion criteria applied, leaving 78 articles included in the qualitative review. The majority of the included articles were of low and moderate quality. Five different commonly used devices were identified; the Intrepid Dynamic Exoskeletal Orthosis (IDEO), the NeuroSwing, the ToeOff, the Chignon, and the Walk On. The IDEO is primarily used in individuals with limb trauma or salvage, and decreased pain and increased function. The NeuroSwing, ToeOff, and Walk On are used in individuals with cerebral palsy, and improved kinematics. The Chignon is used in hemiplegia patients and improved kinematics but induced orthosis dependence. These devices generally had a positive effect on gait kinetics and kinematics.

40 - Henry Hammer

Majors: Physics | Mathematics

Mentor: Dr. Ravitej Uppu (Physics & Astronomy)

Frequency Correlation Measurements of Wavefront-shaped Light in Round, Square, and Rectangular Multimode Fiber Core Geometries

Round-core Multimode fibers (MMFs) have been extensively investigated due to their applicability in endoscopic imaging and optical communication. In particular, various wavefront shaping methods have been developed to achieve higher resolution imaging and high efficiency information transmission. However, alternative core geometries of MMF fibers (for e.g., square or rectangular) have not been investigated until recently for wavefront shaping. In this research project, I perform wavefront shaping of light transmitted through MMFs with square and rectangular core geometries and create foci at the end of long MMFs. Subsequently, I assess the frequency sensitivity of multimode interference on the controlled wavefronts as a function of fiber length, which helps us quantify light scattering in the MMF. Additionally, I investigate the possibility to focus light away from the distal end of the fiber, which could prove handy in realizing fiber-coupled single-photon sources. I conclude that both square and rectangular core MMFs present attractive frequency bandwidths when focusing light at and away from the distal end of the MMF, enabling new experimental opportunities for MMFs in photonics.

42 - Maxwell Herrmann

Majors: Physics | Mathematics

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

Automation and Quality Control for Upgrades to the CMS Outer Tracker

The LHC is planning an upgrade program which will smoothly bring the luminosity up to $5 \times 10^{34} \text{ cm}^{-2} \text{ s}^{-1}$, to possibly reach an integrated luminosity of 3000 fb⁻¹ at the end of the next decade. This scenario, called the High Luminosity LHC (HL-LHC), will require an upgrade to the LHC detectors known as the Phase-2 upgrade. The current CMS Outer Tracker will be replaced by a completely new device to handle the demanding operating conditions and take advantage of the delivered luminosity. In this poster, some design choices for the CMS Outer Tracker upgrade are discussed along with some highlights of the assembly and testing developments.

44 - Ben Hinz

Major: Biomedical Engineering

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

In silico and in vivo analysis of amino acid substitutions that cause laminopathies

Mutations in the LMNA gene cause a diverse group of diseases called laminopathies which can affect muscles, nerves, and fat. LMNA encodes lamins A and C, intermediate filaments with multiple roles at the nuclear envelope. Disease-associated amino acid substitutions were mapped in silico onto three-dimensional structures of lamin A/C, revealing no apparent genotype–phenotype connections. Different amino acid substitutions at the same position within lamin A/C cause distinct diseases, raising the question of whether the nature of the amino acid replacement or genetic background differences contribute to disease phenotypes. Substitutions at R249 cause muscular dystrophies with varying severity. To address this variability, we modeled R249Q and R249W in *Drosophila* Lamin C, an orthologue of LMNA. Larval body wall muscles expressing mutant Lamin C caused abnormal nuclear morphology and premature death. When expressed in indirect flight muscles, R249W caused a greater number of adult wing posturing defects than R249Q, consistent with observations that R249W and R249Q cause distinct muscular dystrophies, with R249W more severe. Here, the nature of the amino acid replacement appears to dictate muscle disease severity. Together, our findings illustrate the utility of *Drosophila* for predicting muscle disease severity and pathogenicity of variants of unknown significance.

46 - Madeleine Hodgson

Major: Communication Studies

Mentors: Drs. Debra Brandt, Donna Santillan (Obstetrics & Gynecology)

Acceptability of mHealth blood pressure monitoring in pregnant women

Due to the COVID public health emergency, there has been a surge in Telehealth that continue to provide health care while maintaining safety for patients and healthcare providers by reducing face-to-face contact.

The NIH defines mHealth as the use of mobile and wireless devices to improve health and can be a component of Telehealth that allows patients to monitor health related conditions at home.

Our study examined the acceptability of a Bluetooth smart phone app and blood pressure cuff (BP app and cuff) during pregnancy. Pregnant women were instructed to perform blood pressure measurements twice daily for two weeks and complete an ease-of-use survey.

Results from our study, the majority of participants found the BP app and cuff easy and convenient to use. Additionally, the majority felt it to be reliable and fit their lifestyle. The majority planned to use it during the remainder of their pregnancy and would recommend it to their friends.

Our study demonstrates that the BP app and cuff has high rate of acceptability for blood pressure measurement among pregnant women. mHealth for BPM may have the potential to be integrated into the Telehealth care of women and provide an alternative to face-to-face clinical monitoring.

48 - John Horne

Majors: Physics | Astronomy

Mentor: Dr. Tom Folland (Physics & Astronomy)

Detection of emerging Volatile Organic Compounds using infrared spectroscopy

To analyze and expand on techniques used to measure amounts of VOCs in air, we will be using infrared spectroscopy and developing a fitting program to try and find the limit to how well we can detect concentrations these gasses.

50 - Brandon Hu

Major: Biomedical Engineering

Mentors: Drs. Christopher Stipp, Maurine Neiman (Biology)

A Novel Treatment Strategy for Drug Resistant Melanoma Cells

Mutations in BRAF, a gene encoding a protein that signals towards cell proliferation, are the initiating oncogenic event in ~40% of cutaneous

melanomas. BRAF inhibitors (BRAFi) often produce profound remission of metastatic BRAF-mutant melanoma; however, BRAFi-resistant melanoma emerges in the majority of cases. Since BRAF rearrangements, including truncations and tandem duplications, are a major underlying cause of BRAFi-resistant melanoma, we sought to identify a fitness trade-off in BRAF-rearranged cells that might lead new treatment strategies. The working hypothesis was that hyperactive, rearranged BRAF might result in replication stress in the absence of BRAF inhibitors that could be therapeutically exploited. Using variants of the A375 human melanoma cell line, we examined different combinations of FDA-approved or investigational drugs that might potentially exacerbate replication stress in BRAF-rearranged cells. Both parental and BRAF-rearranged cells were treated with different drug combinations, and results were analyzed with Synergy Finder software. The most synergistic drug combination we identified was the Wee1 kinase inhibitor, adavosertib, combined with the Jun kinase inhibitor, JNK-IN-8. Adavosertib/JNK-IN-8 combination treatment was selectively cytotoxic for the BRAF-rearranged cells compared to the parental cells. Thus Wee1 kinase/Jun kinase co-inhibition may be a potential treatment strategy for at least some BRAF-rearranged, drug-resistant melanoma cells.

52 - Lauren Johnson

Major: History

Mentor: Dr. Tom Midtrød (History)

Holding Out For a Hero(ine): A Postfeminist Analysis of Superhero Stories from the 1980s

This research thesis focuses on the 1980s and how postfeminism existed within popular culture. Postfeminism is an ideology that believes feminism at minimum ended with the second wave and no longer functions as necessary, as women seem to have legal equality now. I look at postfeminism through the lens of superhero stories from the 1980s. Ultimately, the stories presented show how the overall rejection of feminism in favor of postfeminism after the “success” of the second-wave affected superhero comic culture in America. Additionally, I will look at the inclusion of this ideology around women’s rights in the 1980s in a part of pop culture traditionally produced for men. Men were typically the primary consumers of superhero stories in the 1980s, so the inclusion of feminism (or lack thereof) demonstrated how second-wave feminism and postfeminism impacted the content produced for several groups, including those that were not necessarily directly impacted by these movements .

54 - Spenser Johnson

Major: Biochemistry

Mentors: Drs. Melissa Fath, Doug Spitz (Radiation Oncology)

Superoxide dismutase mimetic GC4419 sensitizes head and neck cancer to conventional fractionated and stereotactic body radiation therapy combined with cisplatin.

Survival rates for head and neck squamous cell carcinoma (HNSCC) have not changed significantly over the past three decades despite the development of standard therapies, including surgery, radiotherapy, and chemotherapy. Complete recovery is achieved in less than 50% of patients. Current treatment modalities are limited due to patient intolerance or toxicity. Therefore, there is a critical need for new, non-toxic therapeutic approaches. Superoxide dismutase (SOD) mimetics are promising adjuvants to radio-chemotherapy as they enhance anti-cancer effects as well as decrease colony size and growth rates by increasing hydrogen peroxide production. The current study demonstrates that Mn(II)-containing pentaazamacrocyclic selective SOD mimetic GC4419 (avasopasem manganese) was able to enhance tumor response to both conventional radio-chemotherapy and stereotactic body radiation therapy (SBRT) radiation doses in HNSCC mouse xenograft while improving survival rates.

56 - Preston Johnson

Major: Neuroscience

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

Examining the Effects of Mood and Anxiety on Functional Outcomes in Schizotypy

Schizotypy (SZY) refers to characteristics that are associated with vulnerability for schizophrenia. Previous studies have established links between SZY, depression, and quality of life (QoL), with depression serving as a mediator. The present study aims to replicate and extend these findings to determine the role of anxious symptoms

Using a regression approach, we tested the relationships between SZY, depression, general anxiety, social anxiety, and QoL in a sample of 60 undergraduate students.

SZY was moderately correlated with the study variables [r 's \geq .35], p 's \leq .01]. A

conditional process model provided a good fit for the data [$F(4,52) = 5.88, p < .006$], with a significant indirect effect between SZY and QoL operating through depression [indirect effect = $-.52 (.20)$, 95% CI: $-.95, -.17$], and a trend for social anxiety to moderate the direct effect [$F(1,52) = 3.22, p = .08$]. Decomposition of the interaction indicated that the strength of the relationship between SZY and QoL was attenuated as level of social anxiety increased.

SZY is associated with lower QoL. Consistent with previous findings, depression mediates this relationship. These analyses also suggest a potential moderation by social anxiety. This study underscores the impact of emotional disturbance on functional outcomes in SZY.

58 - Allysa Jones

Major: Neuroscience

Mentor: Dr. Gordon Buchanan (Neurology)

Effect of stimulation of serotonergic terminals in the PPT on arousal

Sudden unexpected death in epilepsy (SUDEP) is the leading cause of death in patients with refractory epilepsy. SUDEP's cause is unknown, but EEG suppression and arousal deficits may be involved. Previous research indicates that optogenetic activation of serotonin (5-HT) neurons in the dorsal raphe nucleus (DRN) reduces the postictal generalized EEG suppression (PGES). The pedunculopontine tegmental nucleus (PPT) is downstream from DRN and implicated in arousal and EEG changes. We hypothesized stimulating 5-HT projections from DRN to PPT would awaken mice and inhibiting these projections would increase latency to CO₂ arousal. Pet1-Cre and WT mice were implanted with EEG/EMG electrodes and received Cre-dependent AAV-Channelrhodopsin2-mCherry or Archaelhodopsin-YFP injections into DRN and a fiberoptic into PPT. DRN 5-HT terminals in PPT of mice receiving AAV-Channelrhodopsin2-mCherry were stimulated (473 nm or 591 nm control, 4 Hz, 10 mW) during sleep, and arousal time was recorded. Mice receiving AAV-Archaelhodopsin-YFP were exposed to 7% CO₂ during sleep and DRN terminals were inhibited (591 nm, 4 Hz, 10 mW). Activation of DRN terminals decreased latency to arousal; inhibition increased latency to CO₂ arousal. These results suggest this network is important for arousal. Future studies will determine whether this network influences PGES and improves arousal following seizures.

60 - Jack Lauer

Majors: History | Gender, Women's & Sexuality Studies

Mentor: Drs. Landon Storrs (History) and Caroline Radesky (History | Gender, Women's & Sexuality Studies)

Breaking Bread: The Equal Rights Amendment and the Politicization of Foodways, 1972-1982

This project is an analysis of the feminist and anti-feminist politicization of foodways and cooking in support or opposition to the Equal Rights Amendment (ERA). Beginning with the year 1972 when the ERA was passed by the U.S. Congress and concluding with the failed ratification deadline of the ERA in 1982, food and cooking was a formidable strategy used by both anti-ERA antifeminist groups and pro-ERA feminist movements. Feminists and anti-feminists politicized foodways in support and in opposition to the Equal Rights Amendment (ERA) that confirmed and rejected gender roles/expectations, (re) defined the kitchen and home as a feminized space, and reflected complex political contexts.

62 - Linette Leng

Majors: Spanish | Interdepartmental Studies - Health Sciences

Mentors: Drs. Karima Ait-Aissa and Isabella Grumbach (Internal Medicine)

Radiation-induced long-term endothelial senescence and barrier damage.

Endothelial damage has been reported as an important part of normal tissue injury after radiation exposure. We and others have shown that radiation induces an upregulated mitochondrial calcium uptake followed by an increase of reactive oxygen species production leading to in vitro endothelial barrier disruption. Here, we hypothesize that blockage of mitochondrial calcium uptake specifically in endothelial cells will prevent radiation-induced endothelial senescence and barrier disruption. The goal of this project is to study the effect of mitochondrial calcium uniporter (MCU) inhibition on the radiation-induced endothelial senescence and barrier dysfunction. To do this, we will use a novel specific MCU inhibitor, RU265, to block mitochondrial calcium uptake following radiation therapy in human primary endothelial cells. Using this model, we will dissect the effect of radiation therapy on endothelial senescence and endothelial barrier integrity. These studies will point toward a pathway of radiation-induced mitochondrial calcium uptake leading to endothelial barrier disruption and long-term observed endothelial damage.

64 - Bin Rui Li

Majors: Medical Anthropology | Music

Mentor: Dr. Po Hien Ear (Surgery)

Establishment of Two Patient-derived Neuroendocrine Carcinoma Spheroid and Xenograft Models for Drug Testing

Gastroenteropancreatic neuroendocrine carcinomas (GEP NECs) are rare neoplasms with poor prognoses. Few reliable pre-clinical models exist for the study of GEP NECs which limit the investigation of novel imaging and treatment modalities. We describe the establishment and characterization of two patient-

derived GEP NEC spheroid and xenograft models and their application for drug testing. NEC913 and NEC1452 cell lines were derived from surgically resected human GEP NEC tumours. Drug screening experiments and quantitative PCR (qPCR) were performed, and cell viability was measured. NEC 913 and NEC 1452 cell lines are useful as pre-clinical models for the study of neuroendocrine carcinoma. NEC 913 expresses many NEC markers and maintains the histological morphology of the original patient tumour. NEC 1452 expresses a few NEC markers. They present a valuable resource for the identification of novel treatment modalities.

66 - Haley Lightfoot

Major: Chemistry

Mentor: Dr. Tori Forbes (Chemistry)

Exploring the Synthesis and Formation of Extended Uranyl Solid Materials Through a Mild Temperature Flux Reaction

Uranium is a naturally occurring radioactive element, which can form hybrid materials that are of interest due to their ability to have tailorable properties and a wide range of functions. In environmentally relevant conditions uranium (VI) will form a linear triatomic cation with two oxygen atoms, known as the uranyl cation (UO_2^{2+}). Further coordination occurs to the uranium center, generally forming one-dimensional and two-dimensional materials due to the terminal nature of the oxygen atoms in the uranyl cation. Our project looks at the use of uranyl nitrate as a solvent in a flux reaction. Solid citric acid and uranyl nitrate were combined in a parr bomb and heated to 90 and 180 °C. The flux reaction produced yellow plate crystals which were characterized via Thermogravimetric analysis (TGA), powder and single crystal X-ray diffraction, and Raman and IR spectroscopy. The compound crystallized in a three-dimensional network, atypical for uranyl structures. Although the structure is known, the previous synthesis required water, whereas this reaction did not. This synthetic method where the uranyl nitrate acts as the solvent may provide access to unusual structures while taking a green chemistry approach as it avoids the use of additional solvents.

68 - Alexandra Loren

Major: Neuroscience

Mentor: Dr. Hanna Stevens (Psychiatry)

Early Timepoint Prenatal Stress and its Effects on GABAergic Migration

Prenatal stress on embryonic day twelve is known to cause GABAergic interneuron migration delay in the developing cortex of mouse embryos. This project will assess whether the same effects are present if the stress occurs two days prior on embryonic day ten using antibody staining and fluorescence microscopy.

70 - Haley Losh

Major: Neuroscience

Mentors: Drs. Kimberly Leslie and Kristi Thiel (Obstetrics & Gynecology)

Overcoming aggressive p53 mutations in gynecologic cancer

p53 is the most frequently mutated gene in cancer, especially in aggressive ovarian and endometrial tumors. p53 mutations are associated with poor prognosis and resistance to chemotherapy, the most common treatment for advanced gynecologic cancers. We hypothesized that p53 mutations can be used as a biomarker to inform personalized medicine to improve outcomes for women with gynecologic cancers. We first determined the p53 status in gynecologic cancer cell models and patient tumor specimens using a combination of sequencing and approaches to assess protein expression level. Missense mutations were associated with overexpressed p53 protein, whereas frameshift mutations resulted in loss of protein expression. We next examined the efficacy of a histone deacetylase inhibitor and a proteasome inhibitor, a regimen used in other cancer types. In general, cells with missense mutations in TP53 were sensitive to the dual treatment, whereas p53-null cells were resistant. Mechanistic studies identified induction of autophagy as one potential mediator of resistance. Confirming this, treatment with an autophagy inhibitor promoted cell death both in vitro and in vivo in a mouse model. These data set the stage for a future clinical trial of a histone deacetylase inhibitor and proteasome inhibitor in gynecologic tumors with mutated or overexpressed p53.

72 - Pedro Marra

Major: Biomedical Sciences

Mentors: Drs. Gen Shinozaki (Psychiatry), Sangil Lee (Emergency Medicine)

Mortality among patients with sepsis associated with a bispectral electroencephalography (BSEEG) score

Background: We have previously developed a bispectral electroencephalography (BSEEG) device, which was shown to be effective in detecting delirium and predicting patient outcomes. In this study, we applied the BSEEG approach for the detection of sepsis since the current criteria of sepsis include altered mentation, and a more objective measurement is needed.

Methods: Data were analyzed from 628 patients. Sepsis-positive cases were identified based on retrospective chart review. EEG raw data and calculated BSEEG scores were obtained in the previous studies.

Results: The BSEEG score from the first encounter (1st BSEEG) showed a significant difference between patients with and without sepsis ($p = 0.0062$). The mortality of non-sepsis patients with high BSEEG scores was as high as that of sepsis patients with low BSEEG scores. Even after adjusting for age, gender, comorbidity, and sepsis status, BSEEG remained a significant predictor of mortality ($p = 0.008$). Moreover, one-year mortality increased in a dose-dependent manner of BSEEG score among septic patients.

Conclusion: 1st BSEEG score was able to predict patients at high risk of mortality, demonstrating its usefulness as a potential tool for the improvement of screening and management of sepsis.

74 - Katie McAllister; Yuvraj Thakor

Majors: Health & Human Physiology; Health & Human Physiology
Mentor: Drs. Lucas Carr, Erin Litton (Health & Human Physiology)

Theory-based, Student-Delivered Health Coaching Intervention Improves Physical Activity

The Exercise is Medicine initiative has called for programs that connect healthcare with evidence-based physical activity programs. The purpose of this study was to evaluate the feasibility, acceptability, and efficacy of a theory-based, physical activity program delivered by trained student health coaches among a sample of overweight/obese, inactive adults. **Methods.** In Spring 2021, 17 overweight/obese ($BMI > 25.0 \text{ kg/m}^2$), inactive (report < 75 minutes/week moderate-intensity physical activity) adults (18-80 years) were recruited either by referral from their healthcare provider or by responding to a recruitment email sent to community partners. Participants received a 10-week intervention that included weekly remote discussions with a trained student health coach, health education materials based on the Multi-Process Action Control (MPAC) theory, access to a wrist-worn Fitbit activity monitor, and access to fun walking challenges through the Fitbit mobile app. Physical activity (primary outcome) was measured with an ActivPAL activity monitor for five continuous days at baseline and 10 weeks. Secondary outcomes included clinical health outcomes, self-report health outcomes, and MPAC theoretical constructs. Pre/post differences were calculated using a paired t-test. **Results.** A total of 14 participants (65% female, 42.1 ± 11.3 years, $35.4 \pm 7.7 \text{ kg/m}^2$) completed the study (17.7% attrition). Participants significantly increased daily steps/day ($+1,790$ steps/day; $p=0.01$), steps walked at a moderate intensity ($+1,517$ steps/day; $p=0.01$) and total activity scores ($+0.8$ MET.h; $p=0.01$). Participants reported improved general health scores ($p=0.01$), reduced fatigue ($p=0.02$), and improved MPAC constructs including behavioral regulation ($p < 0.01$) and physical activity identity ($p < 0.01$). Participants wore the Fitbits on 63% of all intervention days and attended 84% of all health coaching appointments. Participants reported high levels of satisfaction for all major intervention features. **Conclusions.** These findings suggest our 10-week, theory-based, and student-administered physical activity intervention was effective for improving physical activity, self-reported health outcomes, and targeted theoretical constructs in a small sample of overweight/obese, inactive adults.

76 - Delia Mozqueda

Major: Neuroscience
Mentor: Dr. Kanchna Ramchandran (Internal Medicine)

Digitization of the Switching Stroop Task

The Switching Stroop task is a hybrid of the original neuropsychological test: the Stroop test, which measures inhibition of pre-potent response. The Switching Stroop, in specific, measures the construct of rule generation and selection, which focuses on the ability to select and match appropriate responses to a given cue. The objective is to measure how well an individual can adapt and switch responses to 2 kinds of cues and 4 kinds of stimuli. The original Stroop falls short of measuring the rule selection construct because all cues are

presented simultaneously on every trial. The Switching Stroop resolves this confound by incorporating 2 adaptable cues with varying delay functions, presented singly on a trial-by-trial basis. By presenting the task digitally, various delays in cue presentation could be incorporated, thus creating a more comprehensive measure of the targeted construct. Partnering with a software company, we were able to digitize a previously published version of the Switching Stroop, resolving any issues with user friendliness and functionality. The electronic version of the Switching Stroop provided a plethora for benefits, such as diminished researcher bias and accessibility that assures dependable and accurate data collection and analysis.

78 - Claire Murphy

Major: Microbiology

Mentor: Dr. Craig Ellermeier (Microbiology & Immunology)

Decreased phosphatidylglycerol synthesis increases daptomycin resistance in C. difficile

Clostridioides difficile is an opportunistic pathogen that causes inflammation of the intestines and acute diarrhea usually after antibiotic treatment. *C. difficile* is a growing concern due to its increasing antibiotic resistance. One potential treatment is surotomycin, an analog of daptomycin. Daptomycin is a cyclic lipopeptide antibiotic that targets Gram positive bacteria. Daptomycin inhibits peptidoglycan synthesis by binding a peptidoglycan precursor lipid-II in the presence of the phosphatidylglycerol, a major component of the cellular membrane. To better understand the response of *C. difficile* to daptomycin, we isolated mutants with increased daptomycin resistance. Strains of *C. difficile* with daptomycin resistance were obtained through exposing wild type R20291 to increasing concentrations of daptomycin. We isolated three independent daptomycin resistant strains which each had a different mutation in the essential gene *cdsA*. This gene is predicted to encode for phosphatidate cytidyltransferase, a critical step required for phosphatidylglycerol synthesis. We showed that complementation of these mutants with wild type *cdsA* decreased daptomycin resistance to wild type levels suggesting these were loss of function mutations. We also used CRISPRi to decrease overexpression of *cdsA* which led to an increased daptomycin resistance. Since *CdsA* is required for phosphatidylglycerol synthesis we asked if another enzyme, *PgsA*, required for this synthesis also increases daptomycin resistance. We found decreased expression of *pgsA* increases daptomycin resistance. This suggests phosphatidylglycerol synthesis is required for daptomycin resistance. Interestingly it was recently found that daptomycin complexes with lipid-II only in the presence of phosphatidylglycerol. By understanding how *C. difficile* becomes resistant to daptomycin and other antibiotics we will better understand how to prevent and treat antibiotic resistant bacteria .

80 - Stella Murphy

Major: Public Health

Mentor: Dr. William Story (Community & Behavioral Health)

COVID-19 Vaccine Hesitancy Among African Immigrant Populations in Johnson County, IA: A Qualitative Study

82 - Ethan Page

Majors: Art History | Anthropology

Mentor: Dr. John Doershuck (Office of the State Archaeologist)

Life along the Mississippian Corridor 900-1200 AD

I have been researching Mississippian culture at the state archaeology office since June of 2021. I have been placing archaeological material from the 13PM7 site, which was a fortified village in NW Iowa in the 11th-12th centuries, into a database at the archaeological office. I am also focusing on the topics of settlements in NW Iowa and areas along the Mississippi such as Cahokia.

84 - Ryan Parian

Major: Physics

Mentor: Dr. Jane Nachtman (Physics & Astronomy)

Cooling Tests for the Barrel Timing Layer of the Compact Muon Solenoid Detector

Recent advances in radiation-hard detector technology have enabled the development of picosecond-level timing devices with a variety of uses including high energy particle physics detectors. The Minimum Ionizing Particle Timing Detector (MTD) is being constructed for use in the Compact Muon Solenoid detector at the Large Hadron Collider at CERN in Geneva, Switzerland. This detector will enable time separation of the passage of charged particles with 30-40 picosecond resolution, enabling physicists to analyze collisions with hundreds of interactions and thousands of tracks per LHC collision. The University of Iowa is working with an international team to develop the cooling system for the silicon detectors for this system, including cryogenic testing done at Fermi National Accelerator Lab in Illinois.

86 - Sydney Pearl

Major: Biomedical Sciences

Mentor: Dr. Donna Santillan (Obstetrics & Gynecology)

Mechanisms of COVID-19 Related Poor Pregnancy Outcomes

The current global COVID-19 pandemic is associated with poor pregnancy outcomes including increased risks of preterm birth, fetal/neonatal demise, and hypertensive disease, all of which have long term maternal-child ramifications. SARS-CoV-2 infection occurs when the virus invades epithelial cells. The viral S protein binds to the host-cell angiotensin-converting enzyme 2 (ACE2) receptor, inhibiting ACE2 activity. This binding event results in an increase in Angiotensin II (ANGII) and decrease in counter-regulatory Ang(1-7), an imbalance which can result in cell death, inflammation, and poor cellular function. Despite the expression of ACE2 receptors on the maternal-fetal placental interface, the effect of this adverse mechanism on the placenta has not been explored. This case control study seeks to compare biological samples from pregnant women with confirmed COVID-19 infection to non-infected women. Maternal plasma samples were obtained from the Maternal Fetal Tissue Bank (IRB#200910784) and evaluated for the presence of ANGII hormone via enzyme-linked immunosorbent assay (ELISA)(Biomatik) and copeptin via an automated immunoassay (Brahms

KRYPTOR). Based on analyses of resulting data, there is no statistically significant difference between the copeptin and ANGIII results of plasma samples from mothers with confirmed COVID-19 infection during pregnancy and plasma from non-infected controls.

88 - Isa Perales

Major: Biochemistry

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

Nuclear lamina distortion is not sufficient to cause checkpoint activation in Drosophila GSCs

The nuclear lamina (NL) is an extensive protein network that contributes to stem cell maintenance. The NL protein Emerin, is required for germline stem cell (GSC) maintenance. Loss of *emerin* causes GSC-specific defects in nuclear architecture, including thickening of the NL. These defects are linked to the activation of ATM- and Rad3-related (ATR) and Checkpoint kinase 2 (Chk2), two kinases of the DNA damage response (DDR) pathway. To directly test whether NL structural change can activate the checkpoint in GSCs, we overexpressed NL proteins Kugelkern (Kuk) and Lamin C using the Gal4-UAS system. We found that overexpress (OE) Kuk causes NL ruffling in GSCs, phenocopying *emerin* mutants. However, GSCs are maintained, and oogenesis are normal in Kuk OE flies. These data suggest that NL distortion alone is not sufficient to cause *chk2* activation.

90 - Camellia Pham

Majors: Comparative Literature | Chinese

Mentor: Dr. Adrienne Rose (Comparative Literature, Classics)

Antiquated Past and Storm-Tossed Modernity: Rethinking Comparative Modernisms through Intercultural Translation in Vietnam and China

I study comparative modernisms via a conceptual analysis of translated modernity, coined by Lydia Liu, in Chinese and Vietnamese literature within the context of imperialism. After a thousand years of Chinese domination, Vietnam continued to withstand French colonization. Simultaneously, China endured multiple foreign incursions, from Great Britain's Opium War to the May Fourth Movement as backlash of Japan's imperialist mistreatment. These Western imperial forces triggered a tragicomic struggle of Chinese and Vietnamese intellectuals seeking national independence through literature. Thus, two parallel literary processes of modernization emerged in both nations to reconcile the clash between Eastern and Western values. I mainly investigate texts by The Self-Reliant Literary Union (Tự Lực Văn Đoàn) and The League of Left-Wing Writers (中國左翼作家聯盟 or "Zhōngguó Zuǒyì Zuòjiā Liánméng"). I have developed an argument that the existence of periodicals constituted the waxing and waning of two processes of literary modernization and triggered pro-independence movements. This research further contextualized as for why modern Vietnamese literature reached its zenith with "mal du siècle" romanticism inherited from France, while modern Chinese literature culminated with socialist realism from the Soviet Union. My work also speaks to the ways

modernist texts were adapted to East Asian cultural settings and how they informed the debate between art for art's sake and art for life's sake.

92 - John Piaszynski

Majors: Statistics | Computer Science

Mentor: Dr. Kanchna Ramchandran (Internal Medicine)

LESYMAP: A Statistical Tool For Analyzing Neurological Data

This research project uses a statistical package in the R programming language called the Lesion to Symptom Mapping Toolbox (LESYMAP). Our lab uses one of LESYMAP's processes called sparse canonical correlation analysis for neuroimaging (SCCAN) to perform a multivariate analysis of brain voxels and their association with measured behavior. Our neurological data comes from the Iowa Lesion Patient Registry in the Neurology Department of the Carver College of Medicine, one of the world's largest brain lesion registries. We make use of more than a hundred brain-lesioned patients who had their lesions masked on structural magnetic resonance imaging scans, and also completed a cognitive task that measured temporal and probability discounting. Using the brain-lesion research method, we are currently exploring the relationship between deficits in discounting scores and specific brain anatomical regions. Our implementation of LESYMAP is done in a custom script that reads the brain masks into R and runs the LESYMAP procedure using SCCAN with our variables of interest. After LESYMAP identifies the voxel overlap between scans, it computes a statistical analysis like SCCAN, which finds the weights to apply to individual voxels such that their correlation with behavior is maximized, thereby identifying brain regions implicated in discounting.

94 - Andrea Kathryn Pingol

Major: Nursing

Mentors: Dr. Stephanie Gilbertson-White, Alaa AlBashayreh, Dr. Catherine Cherwin (Nursing)

Evaluating concordance between patient self-reported and provider-documentation symptoms during treatment of cancer

Background: There are vast differences in cancer-related symptoms reported by patients compared to those documented by clinicians.

Objective: The purpose of this project is to determine how patient-reported cancer symptoms correlate with symptoms in provider notes.

Methods: Secondary analysis was done for two datasets—13 patient-reported symptoms using Memorial Symptom Assessment Scale (MSAS) and 13 symptoms extracted from electronic health records using NimbleMiner. Medical record numbers from both studies were compared to find similar participants, totaling 125 participants. We categorized datasets by date and deleted provider notes written >7 days before or after MSAS was taken. We arranged datasets using SPSS Statistics, then used R Studio to calculate correlation with Cohen's Kappa equations.

Results: There is fair correlation (.31) of all symptoms positively agreeing with

provider documentation and substantial correlation (.63) of all symptoms negatively agreeing with provider documentation. The highest positive agreement is with pain and the lowest positive agreement with dry mouth. Conclusion: This analysis shows many symptoms reported by patients are not documented by the provider. The symptom likely reported by both is pain and the least likely to be documented yet patient-reported is dry mouth. This shows a deficit in patient-provider communication that needs addressed.

96 - Amanda Qi

Major: Biomedical Sciences

Mentor: Dr. Shujie Yang (Pathology)

Dual PI3K/Akt and HDAC Inhibitor, CUDC-907, Effectively Inhibits Obesity-Driven Endometrial Cancer Tumor Growth

98 - Salvatore Quaid

Majors: Physics | Astronomy | Mathematics

Mentor: Dr. Vincent Rodgers (Physics & Astronomy)

Projective Black Holes

An attempt to better understand and test the theory of Thomas-Whitehead Projective Gravity and its extension to black holes. Aiding graduate students and professors in the creation of Mathematica files which take the found field equations and attempt to construct a usable metric. Focusing on specific conditions I have helped search for ways to solve certain problems as well as performing calculations simultaneously with others as a way to check the work.

100 - Ajla Rahmanovic

Major: Public Health

Mentors: Drs. Donna Santillan, Debra Brandt (Obstetrics & Gynecology)

The Impact of COVID-19 on Pregnant Women

COVID-19 is a highly contagious respiratory disease with high morbidity and mortality rates. Research has demonstrated increases in anxiety, depression, and worsening of previous mental health issues of the general population. However, the overall impact of COVID-19 on the pregnant population is unknown. Pregnant women were surveyed to determine the impacts COVID-19 has on healthcare, finances, and social support. The result of the survey analysis demonstrates that women who are pregnant have definite concerns regarding COVID-19, including social support, finances, and mental and emotional health. The additional stress during pregnancy, related to COVID-19, has the potential to impose adverse effects on both the mother and child. Our study concluded

that healthcare professionals need to assess women for the impact of COVID and refer them to appropriate support measures, such as mental health professionals, social workers, or other resources. Healthcare providers should be especially aware of the burden of COVID-19 visitor restrictions, especially as they come in for labor and delivery.

102 - Madeline Rhomberg

Major: Health & Human Physiology

Mentors: Drs. Marlan Hansen, Ray Fagenbaum (Otolaryngology), Allen Guymon (Chemical & Biochemical Engineering), Joseph Vecchi (Molecular Physiology & Biophysics)

Calcium Signaling Involvement in Spiral Ganglion Neuron Pathfinding in Response to Biochemical Cues

Spiral Ganglion Neurons (SGNs) transmit electrical signals that allow the perception of auditory stimuli. The intricate tonotopic organization of SGNs and their respective hair receptor cells in the cochlea enable differentiation of sounds of varying frequencies. This precise arrangement is created by directed growth of the neurites by a mechanism called pathfinding wherein the growth cone at the neurite's tip acts to sense biochemical and biophysical cues that orient growth toward a target. An understanding of neuron pathfinding has many clinical applications. The interest in SGNs specifically stems from a drive to improve the efficacy of cochlear implants (CIs) at correctly transmitting auditory signals. These devices rely on a high-resolution signal at the neural-electrode interface. Other applications of potential interest include neuroregeneration following peripheral nerve damage. Pharmacological targets were used to study the effects of ryanodine and inositol triphosphate (IP3)-mediated calcium release on SGN's ability to align to a biochemical pattern. Neuron alignment was measured relative to a laminin striped pattern created via ultraviolet (UV) photodeactivation. This research informs the basic biological processes enabling SGNs to sense and turn in response to substrate cues and the signaling required to direct SGN growth toward targets, such as cochlear implants.

104 - Jackson Russian

Major: History

Mentor: Dr. Nicholas Yablon (History)

Memorialization of the Confederacy in Iowa - (1890-1920) vs. (1990-2020)

In the decades following the American Civil War, The pride of former Confederate citizens towards the accomplishments, virtues, and tribulations of the Confederacy and its troops survived. It emerged into a Neoconfederate identity that spread beyond the geographic boundaries of the former

Confederate States of America into states like Iowa, once considered a segment of the Union. How was the Neoconfederate identity and pride able to survive and thrive through generations in the United States outside the former confederacy, specifically from 1890 to 1920 in states like Iowa? Why was it allowed to thrive by those outside the Confederate identity? How does it compare to Neoconfederate remembrance, memorialization, and identity in an Iowa one hundred years later (1990-2020)? The ways the confederacy and its veterans are remembered will be examined through they were portrayed in mediums of memorialization including physical memorials alongside print memorialization through newspaper articles and books from each period. It will ultimately be seen how the creation of this legacy has had long-reaching effects on our modern America, and Iowa in particular.

106 - Jacob Sindt

Major: Electrical Engineering

Mentor: Dr. Fatima Toor (Electrical & Computer Engineering)

Development of Next Generation Mid-Infrared Sensors for Monitoring Emissions of Greenhouse Gases and Volatile Organic Compounds

Concentrated animal feeding operations (CAFO's) in the mid-west emit high volumes of volatile organic compounds (VOC's) that contribute to the production of ozone, affecting regional air quality. Our work focuses on the production and innovation of an uncooled portable gas spectrometer operating in the mid-infrared wavelength range of 2.5 μm to 5.0 μm that is based upon LED and photodetector technologies to detect local VOC emissions. With the integration of a linear photodetector array into our gas spectrometer, we will be able to achieve part per billion (PPB) measurements of VOC concentrations.

108 - Regan Smock

Major: Sociology

Mentor: Dr. Mary Noonan (Sociology & Criminology)

The Impact of Sexual Assault Prevention Education on Bystander Intervention at Iowa

My project utilizes the University of Iowa's 2015 Speak Out Iowa, sexual assault campus climate survey data to examine the most effective forms of sexual assault prevention educations and trainings offered by the University. To understand effectiveness, I have utilized students' reported bystander intervention practices in a regression analysis and compared three different forms of education and trainings to find which programs had the greatest impact on behaviors. Leveraging multiple academic publications, I am able to tie

the change in these behaviors to a reduced risk of sexual assault occurrence in the community as a whole.

110 - Ayushi Sood

Major: Microbiology

Mentor: Dr. Bhagirath Chaurasia (Internal Medicine)

Ceramide Regulated Gene modulates adipose tissue metabolism

Obesity and its comorbidities are associated with increases in sphingolipids levels, notably ceramides. Systemic and adipose tissue-specific inhibition of serine-palmitoyltransferase (Sptlc), the first enzyme of sphingolipid biosynthesis, alters adipose tissue morphology and increases browning in mice. We performed microarrays on adipose tissue to identify these thermogenic activities isolated from mice fed a high fat diet (HFD) and treated with and without myriocin, a SPT inhibitor. We identified fibroblast growth factor (FGF)13 as a transcript modified by pharmacological inhibition of SPT, as well as deletion of the SPT gene *Sptlc2* in adipose tissue, both in vivo and ex vivo. Cold exposure decreases *Fgf13* expression selectively in adipose tissue in vivo, supporting that it plays a role in modulating metabolic homeostasis. Transduction of adenoviruses containing shRNA targeting *Fgf13* in primary adipocytes, reveals inhibition of *Fgf13* in differentiated adipocytes, exhibits increases in browning and improves mitochondrial respiration.

We generated mice lacking *Fgf13* selectively in adipose tissue (*Fgf13dAdipo*) and thermogenic adipocytes (*Fgf13dUcp1*). Ablation of *Fgf13* in these tissue compartments renders mice refractory to weight gain under an obesogenic diet. These mice exhibit improvements in insulin sensitivity, glucose homeostasis, etc. Collectively, these data suggest that FGF13 is a key regulator of adipocyte metabolism.

112 - Tuan Truong

Majors: Neuroscience | Health & Human Physiology

Mentors: Dr. John Freeman, Matthew Broschard (Psychological & Brain Sciences)

The Roles Of The Dorsomedial Striatum & The Dorsolateral Striatum In Rat Category Learning

Category learning is an essential process by which we group objects according to similarity or function. This allows us to organize our surroundings and generalize to new situations. Multiple patient populations have deficits in category learning, including patients with Parkinson's Disease, which is known to affect the basal ganglia. This study examines the roles of the rodent basal ganglia in categorization. We performed lesions of the dorsomedial striatum (DMS) and the dorsolateral striatum (DLS). Using a touchscreen apparatus, we then assessed the

rodents' ability to categorize simple visual stimuli (Gabor Patches). The results from this study identify subregions (DMS) that are essential for category learning, as well as clarify their specific functions. Preliminary results suggest that lesioning the DMS, but not the DLS, is critical for category learning. The results from this study will identify subregions that are essential for category learning, as well as clarify their specific functions. These results may help inform the underlying mechanisms that are affected in patients with Parkinson's Disease.

114 - Demir Tuken; Eva Donnelly

Majors: Biomedical Engineering | Health & Human Physiology

Mentors: Drs. Lucas Carr, Nathaniel Jenkins (Health & Human Physiology)

The Acceptability and Efficacy of an Active Sitting Device among Sedentary Office Workers

Prolonged sitting is a risk factor for musculoskeletal discomfort, sarcopenia, chronic disease, and premature death. Interrupting sitting with short bouts of physical activity has been shown to be protective. A device called the Fidget Sitter was developed to promote proper posture and core muscle activation while sitting at a desk/computer. This study tested the efficacy and acceptability of Fidget Sitter among 17 sedentary office workers. Healthy adults working in full-time sedentary jobs were recruited. Muscle activation (% maximum voluntary contraction; MVC) was measured with electromyography (EMG) on three core muscles while sitting at rest without Fidget Sitter (control) and while sitting and using Fidget Sitter during 10 isometric and dynamic tasks (treatment). Participants reported use, perceived benefits, and acceptability of Fidget Sitter after four weeks of use. Muscle contractility was significantly higher than control (11.4% MVC) during one isometric task (22.2% MVC; $p < 0.01$). Analysis of EMG during dynamic tasks is ongoing. Participants reported using the Fidget Sitter 272 ± 294 minutes/week. Participants reported improvements in posture, posture awareness, and core muscle contraction. Participants reported they enjoyed using Fidget Sitter. These preliminary findings suggest Fidget Sitter may improve posture and strengthen core muscles while sitting among sedentary office workers.

116 - Joseph Verry

Major: Biomedical Engineering

Heart Failure Medications are Associated with Long-Term Improvement in LV Systolic Function in Patients with Chemotherapy-Induced Cardiomyopathy

Many life sustaining chemotherapy medications, like doxorubicin and trastuzumab, are known to have cardiotoxic effects. This cardiotoxicity can result

in heart failure which can significantly increase morbidity and mortality. Cardiotoxicity normally presents as a decrement in left ventricular ejection fraction (LVEF). In this study, we conducted a retrospective chart review of 23 adult patients with chemotherapy-induced cardiomyopathy. This cohort is middle-aged (64 years), predominantly female (96%), and with relatively few comorbidities except for hypertension (67%). In this population, 7.9 years is the average length of exposure of trastuzumab with 83% being exposed and 61% were exposed to doxorubicin with only 9% having a lifetime dosage above 350 mg/m². The mean drop in LVEF from baseline to diagnosis is 10.7% (\pm 6.9) with almost complete recovery of LVEF once a cardioprotective regimen was in place. The median time to recovery was 96 days with 91% of patients maintaining their LVEF after their recovery. Development of a cardio-oncology clinic has provided the necessary monitoring and prompt treatment of patients with long-term exposure to cardiotoxic chemotherapy regimens. Patients in our cohort were able to maintain chemotherapy regimens, including cardiotoxic medications, for extended amounts of time.

118 - Grant Welk

Major: Biochemistry

Mentor: Dr. Charles Brenner

Innate Immune responses associated with viral, bacterial, and parasitic infection stress of the NAD metabolome

The NAD system is disrupted in conditions of obesity, heart disease, peripheral neuropathy, noise-induced hearing loss, and aging. Most recently, the NAD system has been shown to be disrupted during infection, which correlates with the induction of IFN-sensitive PARP enzymes. We sought to expand our understanding of the effect of inflammatory cytokines and viral infection on the NAD system. To this end, publicly available datasets including models of cytokine treatment and viral infection were analyzed for changes in expression of NAD-related genes. It was observed that Class I and II interferon (as well as TNF α , TGF β , and certain classes of interleukins) consistently upregulate IFN-responsive PARP enzymes across a variety of studies and conditions of infection. In Nanostring and Calu qPCR analysis, it was further observed that interferon was sufficient to induce the expression of non-canonical PARPs, which leads to a depletion of cellular NAD⁺ levels. These results suggest that various mechanisms of viral infection perturb the NAD metabolome by induction of IFN-responsive PARP enzymes and that IFN signaling alone is sufficient to stress the immune system.

