The 18th Annual
Spring Undergraduate Research Festival

Wednesday, March 30, 2022
4:00pm-6:00pm

University of Iowa
University Capitol Centre
2nd floor South Atrium
Iowa City, Iowa
This event is hosted by the
Iowa Center for Research by
Undergraduates.

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

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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 present 4:00-5:00PM**

**Even numbered posters present 5:00-6:00PM**

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

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

Programs with full abstracts are available on the ICRU website.

**Upcoming ICRU Events and Opportunities**

- ICRU Research Fellowship Applications Due:
  - *Summer* - April 1, 2022
  - *Academic Year* - April 22, 2022
1. Adrian Acosta  
Majors: Physics, Economics  
Mentor: Dr. Zachary Girazian (Physics and Astronomy)  

*Visualizing Mars’s Ionosphere response to a Changing Solar Flux*  

Since 2014, NASA’s MAVEN (Mars Atmosphere and Volatile EvolutioN) spacecraft, which orbits Mars, has gathered data to observe the effects by the Sun and solar wind on its upper atmosphere. The MAVEN data includes the first comprehensive observations of the ionosphere of Mars - a thin layer of charged particles embedded in the upper atmosphere. Our research aims to answer one question: how does the chemical composition of the ionosphere respond to the changing solar flux due to the Sun’s 27-day rotation period? Our initial results show how the densities of different ions respond to the varying solar flux. We find that some ions, such as C+, respond significantly, while others, such as NO+, are less responsive. As we continue our research, we will use our results to assess the accuracy of models of the ionosphere of Mars.

3. Jessica Bednar  
Major: Speech and Hearing Sciences  
Mentor: Dr. Stewart McCauley (Communication Sciences and Disorders)  

*Modeling Semantic Networks in Pediatric Cochlear Implant Recipients*  

Previous research has shown that semantic network models of the emerging lexicon can illuminate language development, with interconnected network structures predicting more fluid real-time language processing. However, less is known about the structure of the lexicon in children that access the acoustic signal through cochlear implants (CIs). The present study examines data from a group of pediatric CI users from the Iowa CI Research Center. We predicted that bilateral CIs would yield richer semantic networks than unilateral CIs, as would younger age of implantation, and that there would be an interaction between implantation age and number of devices. Surprisingly, number of devices was not a predictor of network structure or vocabulary size. Instead, we found that an interaction between age of implantation and the number of months after implantation predicted not only vocabulary size,
but also measures reflecting semantic network interconnectedness, with earlier age of implantation leading to richer networks. Additionally, comparison of network model structures to those from a large cohort of pediatric hearing aid users showed qualitative differences in lexical development between children who are hard of hearing and CI users, suggesting the possibility of qualitative differences in lexical development across the two populations.

5. Natalie Biggerstaff  
Major: Human Physiology  
Minor: Chemistry  
Mentors: Drs. Kanza Khan, Catherine Marcinkiewcz (Neuroscience and Pharmacology)

**Social Isolation and Pain in htau Adolescent Mice (tentative)**

Htau mice are a specific strain of mouse used in experiments to look at the behavior pathology of the htau gene. In this specific experiment, I explored how activation of the htau gene in male adolescent mice would affect social and anxiety-like behavior as well as pain responses to mechanical and thermal pain stimulants. After being perfused, we observed slices of their brains (specifically, in the dorsal raphe nucleus) to discern if any changes in brain function were notable.

7. Nicole Boodhoo  
Major: Biomedical Sciences  
Minor: Global Public Health  
Mentor: Dr. Gordon Buchanan (Neurology)

**Examination of a role for corticosterone in seizure-induced death in an amygdala kindled mouse model of epilepsy**

Epilepsy affects 65 million people worldwide. One-third of these patients will not achieve seizure control with medication putting them at high risk of sudden unexpected death in epilepsy (SUDEP). Previously, our lab found that the serotonin (5-HT) 2C receptor agonist, MK-212 increased seizure-associated mortality. We found that this also happened in 5HT2C knockout mice, suggesting an off-target effect of MK-212. Since MK-212 increases corticosterone, the major stress hormone in rodents, and stress is a risk factor for seizures, we aimed to examine a role for the corticosterone pathway in SUDEP pathophysiology. We hypothesize that increased seizure-induced death with MK-212 is due to increased levels of corticosterone, leading to increased seizure severity, and that blocking corticosterone receptors prevents MK-212-induced death. This study is currently in progress. Our design is to instrument male and female C57BL/6J mice for EEG recording and amygdala kindling, kindle
the animals, induce seizures following treatment with MK-212 plus either vehicle or the corticosterone antagonist (CORT-113176) or CORT-113176 plus vehicle while measuring EEG and breathing, and assess seizure severity, survival, and effects on breathing. We expect to observe increased death with vehicle + MK-212, and reduced death with CORT-113176 + MK-212. Interim results are presented.

9. Allison Buerschen
Major: Communication Sciences and Disorders
Minors: American Sign Language, Disability Studies
Mentor: Dr. Elizabeth Walker (Communication Sciences and Disorders)

Readability and Quality of Pediatric Diagnostic Audiology Reports

Timely identification of hearing loss (HL), hearing aid fitting, and enrollment in early intervention is critical to the language and educational achievement of children with HL. One potential barrier is lack of effective written communication between professionals and parents of children with HL. A lack of effective communication may be related to the health literacy levels of caregivers and/or audiologists’ use of language to describe diagnostic audiology process and outcomes. Little research has focused specifically on determining readability and quality from diagnostic clinical reports for infants at the time of a first diagnosis of early HL. The current study seeks to characterize the readability and quality of 378 de-identified diagnostic pediatric audiology reports. Research aims addressed the following questions: 1) What is the readability of the clinical reports? 2) What is the quality of the clinical reports? 3) What is the correlation between the readability and quality of the clinical reports? Our results indicated that the readability scores averaged a 11.6 grade reading level, exceeding the recommended fourth grade reading level. The long-term goal of this research study is to develop evidence-based strategies to improve written communication between audiologists and parents of children with HL.

11. Taylor DeMello
Majors: Neuroscience, Mathematics
Minors: Biology, Chemistry
Mentors: Drs. Chun-Fang Wu, Atulya Iyengar (Biology)

Uncovering biophysical and molecular bases of aberrant voltage-gated and calcium-mediated potassium currents in D. melanogaster mutants using neuromuscular electrophysiology and computational modeling

Abnormalities in nerve excitability underlie several categories of neurological disorders, including seizures in epilepsy and deficiencies in
motor coordination. A number of genes encoding ion channels in D. melanogaster have been well-characterized and are known to be homologous to the defective human ion channels implicated in epileptic seizures, though there remain phenotypes that are less understood. Shaker wings down and Shudderer are two Drosophila mutants with specific phenotypes linked to defined lesions in the genes that encode for sodium channels, which are essential for the majority of active propagation of nerve signals. Although many of the systems of molecular mechanisms responsible for complex patterns of altered neuronal activity require further investigation, the general biophysical principles underlying nerve excitability are well established. Quantitative models of nerve excitability take advantage of these established principles in order to facilitate predictions about alterations in nerve excitability patterns. This model provides insight into the plausible mechanisms behind two varieties of aberrant sodium channel activity and could possibly help optimize the use of time and resources involved in devising and carrying out future experiments in vivo.

13. Jatin Dhamrait
Major: Biomedical Engineering
Minor: Premed Track
Mentor: Dr. Joseph Reinhardt (Biomedical Engineering)

Association of Airway Geometry with Chronic Obstructive Pulmonary Disorder

The fourth leading cause of death in the United States during 2018 was chronic obstructive pulmonary disorder (COPD). Existing literature shows that function of the lungs is related to airway geometry. A python pipeline was developed to calculate airway geometry from lung Computed Tomography (CT) images. The tracheobronchial angle was extracted and analyzed in a cohort of 543 subjects. Subjects were selected from various locations throughout the United States. Our results were similar to an earlier study with a smaller population; however, we observed that other variables, such as sex, lung function, and smoking tendencies, mediate the relationship between branching angles and COPD. Further work is needed to examine alternative geometric calculations of branch angles and how these angles are related to COPD progression.

15. Ben Eastman
Major: 3D Design
Minor: French
Mentor: Monica Correia (3D Design)

Exploring Form with Soft Materials
Professor Correia and I have been applying our textile research to a large seating project that will be finished soon. Our seat is a result of a form experiment with felt, a thick, natural textile commonly used in interior design. A host of problems have arisen since we began to translate our research to the full scale seat, all of which we've had to solve in real time. In my presentation, I will explain our hypothesis, original intentions, discoveries, and give a step-by-step look at how we translated the findings to a large project.

17. Brian Fisher  
Major: Public Health  
Minor: Statistics  
Mentors: Drs. Hui Wang, Hans Joachim-Lemhler (Occupational and Environmental Health)

_Determination of Lipid Content of Tissue in PCB-exposed Germ Free and Conventional Mice_

Polychlorinated biphenyls (PCBs) are persistent, bio-accumulative toxic pollutants which are a known carcinogen. They are highly present in our environment, as they were used as a building material until they were banned in 1979. The goal of this research is to test how PCBs from the Fox River in central Wisconsin affect various tissues and excrement from mice who have been spiked with different doses. Liquid-Liquid Extraction is used to separate PCB and lipids from the tissue. The PCBs were measured using Gas Chromatography Mass Spectrometry to analyze which specific types of PCBs were found. In a separate process, the lipid was extracted from the tissue, dried, and then weighed. For PCB, we are comparing results amongst the different dose levels. In lipids, we are comparing the different tissue types to each other and comparing male and female and conventional and germ-free phenotypical mice.

Major: Biology  
Minor: Environmental Science  
Mentor: Dr. Andrew Forbes (Biology)

_Understanding the Diversity of Species within the Genus Torymus_

I am studying the diversity of a genus of parasitoid wasps called Torymus. With many of these wasps, they are often categorized by morphological data alone which leads to many specialist species getting grouped together as one "generalist" species. This changes our biodiversity greatly and stops us from the potential to prevent a variety of agricultural pests.
21. Lauren Groenenboom  
Majors: Human Physiology, Enterprise Leadership  
Minor: Chemistry  
Mentors: Kevin Hunter, Dr. Nicole Becker (Chemistry)

*A qualitative analysis of undergraduate students’ explanations and predictions for organic reaction mechanisms*

Organic chemistry is a key gateway course for STEM and health degrees, but often has a very high attrition. Our goal is to support student learning and improve the number of students who succeed in organic chemistry by studying students’ thought processes about reaction mechanisms. Understanding reaction mechanisms is important because they represent the causes and pathways of chemical change at the molecular level. By learning to think about mechanisms, students can move away from unreliable rote memorization and towards critical thinking. In this project, our research question is: In what ways do students use visual cues and prior knowledge to predict the type of mechanism that will take place? To answer this question, we will conduct problem-solving interviews with organic chemistry students at the University of Iowa. Videos and written work from the interviews will be qualitatively analyzed to characterize ways in which students make informed decision about By translating research to practice, for instance by developing curricular resources informed by the problem solving strategies we observe, a large number of organic chemistry students across the nation, including those at Iowa will be impacted.

23. Emma Grunkemeyer  
Major: Human Physiology  
Minors: Microbiology, Chemistry  
Mentor: Dr. Jan Fassler (Biology)

*Identification of Genes Affecting Fermentation in S. cerevisiae*

We know that wine yeast (WY) are efficient fermenters, and that MED15 is important in fermentation. To examine the importance of sequence differences in the WY MED15 alleles, we transplanted the MED15 gene from the wine yeast into a lab strain and conducted multiple fermentation assays to study the influence of the deletion/overexpression of genes or the addition of arginine added to supplement the media.

25. Megan Grunst  
Major: Biomedical Engineering  
Mentor: Dr. Jason Wilken (Physical Therapy and Rehabilitation Science)
Effect of an Integrated Physical Therapy Rehabilitation Program and Carbon Fiber Ankle Foot Orthosis on Mobility and Pain

The use of carbon fiber ankle foot orthoses (CDOs) with an integrated rehabilitation program has been shown to improve pain and functioning in a military setting, but civilian data is limited. The records of 131 patients with chronic lower extremity disability, who received a novel CDO and training program were reviewed. Patient reported measures of pain and lower extremity function and physical measurements of walking and agility were extracted at baseline and upon program completion. These patients were contacted an average of 4 (±1) years post-intervention to complete a survey regarding their pain and functioning. Immediately after program completion, most patients reported improved physical function, decreased pain, and increased walking speed and agility. Improvements in pain were most influenced by baseline pain and improvements in function were most influenced by sex and baseline function. The 63 patients that responded to the long-term follow-up survey reported sustained improved function and pain. Long-term pain reduction and improved function were predicted by measures collected at baseline and short-term changes. These results show that improvements with a CDO and training program in a civilian population can be sustained in the long-term.

27. Vivien Harrell  
Major: Speech and Hearing Science  
Minor: Spanish  
Mentor: Dr. Elizabeth Walker (Communication Sciences and Disorders)

Reading Comprehension of Adolescents who are Hard of Hearing

Children who are hard of hearing demonstrate significant deficits across multiple developmental domains. Lack of experience with early auditory access in children with a congenital hearing loss experience can have a cascading effect on later language and literacy outcomes; however, most research studies have focused on the impact of reduced hearing on early word reading and decoding skills, with less of an emphasis on reading comprehension. This study addresses the following questions: 1) Do adolescents who are hard of hearing show delays in their reading comprehension skills compared to adolescents with typical hearing? 2) Does degree of hearing loss impact reading comprehension skills on a qualitative reading inventory? 3) What is the role of working memory, grammar, and vocabulary skills on reading comprehension skills? 4) What is the association between prior knowledge and reading motivation on reading comprehension? All participants were in middle school (7th or 8th grade) at the time of testing. 10 adolescents with hearing loss and 12 adolescents with typical hearing participated. Participants completed a
battery of cognitive, language, and literacy measures, including the Qualitative Reading Inventory, 6th edition. Data analysis is currently underway, and results will be available at the time of this colloquium.

29. Ciara Harrington  
Major: Psychology  
Minor: Spanish  
Mentor: Dr. Bengi Baran (Psychological and Brain Sciences)

Effects of Mood symptoms on sleep dependent emotional processes

This study investigated the effects of elevated mood symptoms on sleep physiology and sleep-dependent consolidation of emotional memory. Depressive or anxious symptoms in healthy adults have been associated with emotional memory biases, disturbed sleep, and poorer cognitive function. Previous studies have shown that sleep plays a critical role in memory consolidation and selectively strengthens newly acquired salient information. Yet, little is known about how sleep influences consolidation of emotional memories for healthy individuals who differ with respect to self-reports of high vs low depressive and anxious symptomatology. This study examined the difference in sleep-dependent memory consolidation of emotional memory for individuals with high depression and anxiety symptom ratings and individuals with low depression and anxiety symptom ratings. Participants were invited to lab for a mid-day sleep recording session, which involves polysomnography (PSG) and an emotional memory task. The first part of the task consisted of participants studying emotional picture stimuli and rating them in terms of emotionality. Post nap, memory for these items were probed with a recognition task. Changes in memory performance and emotionality ratings over this 5-hour period were attributed to sleep.

31. Felipe Herrmann  
Major: Psychology  
Minor: Human Relations  
Mentor: Dr. Emily Thomas (Psychological and Brain Sciences)

The Impact of the COVID-19 Pandemic on Educator Mental Health

The COVID-19 pandemic has been an exceptionally challenging time for people worldwide affecting physical, social, and mental functioning. Despite prior research indicating that K-12 educators are at greater risk for anxiety and depression, little research has investigated the impact of the pandemic on this group. The current study measured internalized symptoms among educators during November and December of 2020, during the early stages of the COVID-19 pandemic. There were 853
adult English-reading participants, who worked within a school system in the United States. They were recruited via Facebook and Reddit and participated through Qualtrics in an online self-report questionnaire. The Inventory of Depression and Anxiety Symptoms (IDAS-II) was used, a valid and normed measure. T-score statistics were used to characterize the results relative to national norms, which demonstrated elevated levels of mood and anxiety symptoms and low levels of well-being. For example, the General Depression composite median score in the educator sample was 3 standard deviations above the normative mean (T-score: 81). Future research is needed to investigate and provide interventions to address the mental health of educators across the United States.

33. Emily Herum
Majors: Biochemistry, Music
Mentor: Dr. Madeline Shea (Biochemistry and Molecular Biology)

_Dysfunctions of Pathogenic Mutants of the Essential Calcium Sensor Calmodulin_

Calmodulin (CaM) is an essential protein required for all eukaryotes. It is a highly conserved intracellular calcium receipt that regulates cellular responses to transient calcium fluxes. Its target proteins include many kinases, receptors, and ion channels that control signal transduction, muscle contraction, and immune responses including organ rejection. Cooperative binding of 4 calcium ions causes large conformational changes in CaM domains N and C. We are exploring how mutations change calcium binding and CaM-mediated regulation of its target proteins. This is particularly an area of interest, as recent findings show that some mutations in CaM can cause numerous different diseases.

35. Adelaine Horan
Majors: Music Education, Clarinet Performance
Minor: Certificate in Nonprofit Leadership and Philanthropy
Mentor: Dr. Adam Harry (Music)

_Critical Analysis of Racial and Cultural Representation in Beginning Band Method Books_

In recent decades, music education researchers and teachers have become increasingly concerned with the issues of racial and cultural representation and equity in music classrooms (Abril; 2006; Bradley, 2006; Hess, 2017). Despite the widespread use of classroom method books in beginning bands, almost no critical examinations of how they represent race and culture currently exist (e.g., Brittin & Sheldon, 2004; Taylor, 2021). Through the learning and performance of cultural products,
music classes play a unique and substantive role in students' developing understandings of race and culture. The purpose of this study was to examine the cultural and racial content, visual and discursive, in classroom band method books published within the last two decades. We examine: a) the use of non-Western musics; b) whether they are accurately titled and attributed; c) the degree to which contextual information about the music and culture is provided; and d) use of offensive language or colonialist frames in the text. Implications for teaching practice include either eliminating or supplementing the use of method books in beginning band classes. If method books are retained as an instructional tool, teachers should problematize and analyze problematic racial and cultural representations in these materials with their students.

37. Emily Huber  
Major: Psychology  
Mentor: Dr. Isaac Petersen (Psychological and Brain Sciences)

Neural correlates of anxiety in young children: A literature review

Anxiety affects about half of Americans in their lifetime, with onset typically occurring in childhood or adolescence. Diagnostic systems rely exclusively on behavioral symptoms, lacking information about neural processes which could be used for earlier implementation of treatment for at-risk children. The aim of this literature review was to investigate neural processes that have been associated with anxiety symptoms and disorders in young children. To examine this question, I conducted a systematic literature review of the error-related negativity (ERN) event-related potential, frontal electroencephalography asymmetry, and brain structure and function in relation to anxiety in children aged 0–7 years. Using PsychINFO, PubMed, and Web of Science, I identified 2,537 articles for screening; of these, I selected 23 articles for thorough review. Based on findings in these studies, anxiety symptoms in childhood are related to larger ERN amplitudes, and to hyperactive amygdala activity and increased amygdala-cingulate connectivity. Right frontal asymmetry is associated with anxious/withdrawn behavior as early as infancy. Future research should examine the developmental trajectory of these neural correlates of anxiety and their response to intervention to determine which might be most effective in aiding diagnostic and treatment protocols.

39. Brianna Iverson  
Major: Biology  
Minor: Public Health  
Mentor: Dr. Joshua Weiner (Biology)
**Identifying critical roles for Akirin2 in astrocytes**

Akirin2 is a highly conserved nuclear protein that is important for a variety of developmental processes. We previously showed that Akirin2-knockout mouse neurons die by a necroptotic process over months, a phenotype reminiscent of human neurodegenerative disorders. Here, we characterize Akirin2-null phenotypes in astrocytes, glial cells that play critical roles in brain development and function, including neuronal maturation, survival and synapse formation. Utilizing a GFAP-Cre driver to restrict conditional Akirin2 knockout to astrocytes, we identified morphological and survival defects in mutant cells, focusing on cerebellar Bergmann glia. We find a progressive loss of Bergmann glial processes, which results in disruption of neuronal migration and of Purkinje cell layer organization in Akirin2-null mice. Knockout Bergmann glia do not undergo apoptosis, but exhibit a massive increase in expression of tumor suppressor p53, also associated with necroptotic death in Akirin2-null neurons, throughout the cerebellum. Astrocyte-restricted Akirin2-knockout mice display seizures and reduced growth rates, indicative of disrupted neural functioning. Together with our prior work, these results identify critical roles for Akirin2 in the maturation of both neurons and glia in the postnatal nervous system.

**41. Ashleigh Jacobs**
Major: Neurobiology  
Minor: Environmental Science  
Mentor: Dr. Daniel Eberl (Biology)

*Role of Ion Transporters in Drosophila Mechanosensory Support Cells*

The functional units of the Drosophila melanogaster auditory system consist of the Johnston’s Organ (JO), which is made up of ~250 individual scolopidia and is located in the 2nd antennal segment (Figure 1). The scolopidia respond to environmental stimuli like sound, wind, and gravity by transducing the movement of the arista and the 3rd antennal segment into electrical signals. Chordotonal neurons associated with the JO are able to fire and transmit nerve impulses due to the ion gradient established in the fluid chamber enclosed in the scolopidia (the scolopale space). This project investigates specific ion transporters’ roles in maintaining this gradient and their effect on fly hearing.

**43. Andrew Janni**
Majors: Accounting, Economics  
Minor: Informatics  
Mentor: Dr. Hennadige Thenuwara (Economics)
**Ethical Frameworks for Portfolio Management and Resilience**

A literature review and case study that examines 3 approaches to investment ethics (responsible investing, ESG investing, and Impact Investing) and compares funds that fit each method to market performance with a focus on the 2008 recession and 2020 pandemic stock market downturn.

45. **Emma Jewell**  
Majors: Communications, German  
Minors: English, Certificate in Trauma and Resilience Informed Perspectives  
Mentor: Dr. Waltraud Maierhofer (German, Global Health Studies)

**Representations of Abortion in Media, Literature, and Film Across Germany and America**

My research examines the representations of abortion in current media, literature, and film across the United States and Germany. My research aims to examine how these representations expand our views and understanding of abortion, as well as counter stigmas surrounding the procedure, thus granting space for such a procedure. My research also aims to compare how each country handle such a topic, advocating to overall greater access to abortion in both countries.

47. **David Keffala-Gerhard**  
Majors: Biology, Philosophy, Ethics & Public Policy  
Minors: Chemistry, Spanish, Music  
Mentor: Dr. Alexander Bassuk (Pediatrics)

**Naltrexone, a mu-opioid receptor antagonist, decreases neuroinflammation and prevents post-traumatic epilepsy**

Traumatic Brain Injury (TBI) induces a neuroinflammatory response that can initiate epileptogenesis, a pathological progression towards epilepsy. Recently, we identified the anti-convulsive properties of naltrexone, a mu-opioid receptor (MOR) antagonist already approved and widely used for drug addiction and binge eating. While blocking opioid receptors can reduce inflammation, it is unclear if post-TBI epileptogenesis can also be prevented by blocking MOR with naltrexone. Here, we tested if naltrexone prevents epilepsy after TBI using a pentylenetetrazol (PTZ)-induced mouse model of epilepsy. In the cortex of TBI mice, increased MOR activation was followed by an upregulation of IBA1 and Fluoro-Jade-B-positive cells. mRNA and protein expression of pro-inflammatory cytokines and nitro-oxidative
stress markers was also significantly increased. None of the animals treated with naltrexone became epileptic, whereas 43% of animals with TBI developed epilepsy. The number of interictal events were significantly reduced in naltrexone-treated mice compared to the TBI group. Significant white-matter damage was detected by neuroimaging (especially in the corpus callosum and neocortex), that was substantially reduced by naltrexone treatment. Thus, our results identify naltrexone as a promising candidate to prevent TBI-associated neuroinflammation and post-traumatic epilepsy.

49. David Kim
Major: Neuroscience
Minor: Pre-medical Track
Mentor: Dr. Catherine Marcinkiewcz (Neuroscience and Pharmacology)

Structural remodeling of serotonin pathways in the brain after chronic alcohol use.

Alcohol dependence is a chronic relapsing disorder that afflicts over 14 million people in the United States. Previous work in our lab has found that chronic alcohol exposure disrupts social behavior during acute withdrawal. We also find that withdrawal related anxiety-like behavior is associated with hyperactivity of serotonergic (5HT) neurons in the dorsal raphe nucleus that project to the nucleus accumbens, a brain region that is involved in reward processing. Within the nucleus accumbens, there is also upregulation of serotonin receptors, which may be a compensatory response to reduced serotonergic input from the raphe nucleus. In the present study, we tested the hypothesis that chronic ethanol exposure affects 5HT output from the DRN to the Nucleus accumbens and other downstream regions. Adult SERT-cre mice were infused with viral vectors encoding Cre-inducible fluorescent anterograde tracers into the DRN and underwent an 8-week voluntary access to ethanol paradigm. Following chronic ethanol exposure, animals were sacrificed and their brains extracted for immunohistochemical analysis of DRN5-HT projections to the nucleus accumbens and other downstream regions.

51. Hannah Krug
Major: Speech and Hearing Science
Minor: Psychology
Mentor: Dr. Si On Yoon (Communication Sciences and Disorders)

Sensitivity to the Historical Discourse Context in Individuals with Autism Spectrum Disorder

Production research suggests the relevant discourse context is broad, based on findings that speakers distinguish new discourse referents from
non-present referents discussed in a previous context. For example, after referring to “the umbrella,” a different umbrella is likely to be called “the striped umbrella” although a single umbrella is currently visible. Although this phenomenon is robust, underlying mechanisms have not been revealed – whether it benefits listener’s understanding or facilitates speaker’s production. We tested this question working with individuals with autism spectrum disorder (ASD) who often face challenges taking others’ perspectives. 14 adults with ASD and 14 adults without ASD completed a referential communication task. Participants viewed 4 pictures and described the target image for the experimenter. On critical trials, a target referent (e.g., open striped umbrella) was from the same category as an earlier exemplar (e.g., closed umbrella; differentiation condition) or from a different category (e.g., closed bottle; non-differentiation condition) that had previously been described. We found that both groups produced more modifiers in the differentiation condition than the non-differentiation condition. However, there was no significant group difference in modifier use. These results provide insight that this differentiation effect is not primarily driven by speakers’ motivation to help listeners’ understanding.

55. Zoe Leone
Major: Environmental Sciences
Minor: Biology
Mentor: Dr. Heather Sander (Geographical and Sustainability Sciences)

*Relationships between sex ratio and habitat fragmentation in urban white-footed mice (Peromyscus leucopus)*
Urbanization fragments habitats, potentially reducing ecological functionality by isolating populations of organisms. This isolation increases risk of local extinction in habitat patches that can escalate to regional extinction. The effects of fragmentation vary with organism size such that smaller species, given lower dispersal abilities, may be more vulnerable than larger ones. Consequently, white footed mice are more likely to experience extreme consequences of habitat fragmentation than larger species. The effects of fragmentation may alter sex ratios by limiting female dispersal more than male dispersal. If habitat fragmentation affects sex ratios, subsequently reduced reproductive success in local populations could threaten overall evolutionary stability. To investigate this relationship, I used linear regression to identify relationships between a habitat fragmentation metric, contagion, estimated using land-cover data and the sex ratios of white-footed mice surveyed using live trapping on 45 sites in the Iowa City area. Habitat fragmentation was negatively related to the proportions of female mice on a site. Because male-skewed populations are more vulnerable to local extinction, this finding suggests a potential extinction vulnerability for white-footed mice. Given the key role mice play in food webs, disruption to these populations may have broader implications for urban.
plants, predators, and local human residents.

57. Haley Lightfoot  
Major: Chemistry  
Minor: Environmental Sciences  
Mentor: 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 ($\text{UO}_2^{2+}$). 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 critic 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.

59. Courtney Maire  
Majors: Leadership Management  
Minors: Chemistry, Human Physiology  
Mentor: Dr. Barry London (Internal Medicine)  

Putative Cardiomyopathy Mutation in Muscle Segment Homeobox 1 (MSX1) Reduces Binding with T-box Transcription Factors TBX3 and TBX5.

Sudden cardiac death (SCD), death occurring within one hour of the onset of symptoms, causes more than 400,000 deaths annually in the United States. While SCD often results from myocardial infarction, a subset of SCD is caused by heritable rhythm disorders and myopathies. Often, clinical genetic testing panels are used in the clinical setting. While clinical genetic testing can identify a mutation causing disease within a family, it is common to find no definitive mutation which would cause disease.
We investigated a large, multigenerational family who displayed multiple phenotypes including cardiac arrhythmia, idiopathic cardiac fibrosis, bicuspid aortic valve, and sudden death. We identified a putative mutation, MSX1;p.E135D, in all affected members of the family. MSX1 is reported to interact with transcription factors TBX3 and TBX5 and regulate transcription of target genes. Co-immunoprecipitation experiments demonstrate that MSX1;p.E135D reduces, but does not eliminate, binding with TBX3 or TBX5.

MSX1;p.E135D may be the cause of disease in this large, multigenerational family. Altered binding to TBX3 and TBX5 may be the first insight into a mechanism of disease. Future luciferase assays and mouse models will investigate the impact of reduced TBX3 and TBX5 binding caused by the MSX1;p.E135D putative mutation.

61. Shivani Manikandan
Major: Biochemistry
Minor: Statistics
Mentor: Dr. Christopher Ahern (Molecular Physiology and Biophysics)

An Investigation of the Metabotropic Glutamate Receptor 8 Binding Site.

The metabotropic glutamate receptor 8 (mGlu8) is a G-protein coupled receptor that is activated by glutamate binding, and associated with the regulation of neural activity. mGlu8 is a target for medications intended to treat a variety of health conditions such as schizophrenia and depression. However, off-target effects from drugs lacking binding specificity cause a wide range of adverse effects. This project strives to understand specific intermolecular interactions between the mGlu8 and its ligand using unnatural amino acid mutagenesis to selectively impair important binding site interactions. A radioligand binding assay will be performed to quantify the relative binding affinity of the receptor to ligand in the mutant versus wild-type proteins. This will provide insight as to which interactions are necessary for ligand binding. Our findings may be leveraged to design future medications intended to treat neurodegenerative diseases and mental health disorders with greater specificity, reducing risks of side effects.

63. Suzanne Mason
Major: Neuroscience
Minor: Informatics
Mentor: Dr. Catherine Marcinkiewcz (Neuroscience and Pharmacology)

Effects of Viral Vector-mediated P301L-tau Overexpression on Mouse Sleep State
A detrimental yet poorly understood symptom of Alzheimer’s disease is sleep disturbances, particularly a reduction in slow wave sleep and rapid eye movement (REM) sleep. A hallmark of Alzheimer’s-related neuropathology is the aggregation of tau proteins. To study the effect of these tau aggregations on sleep, we induced tau pathology in the dorsal raphe nucleus of 8-week old male wild-type mice via injection of a viral vector overexpressing P301L-tau, a genetic factor associated with fronto-temporal dementia and Alzheimer’s disease. Using electroencephalographic data recorded at four, eight, and twelve weeks after infusion of viral vector, we quantified sleep parameters, including duration, sleep bout length, and bout frequency. Our results show a significant decrease in REM sleep (p = 0.0216), as well as number (p = 0.0104) and bout-length distribution (p = 0.0072) at week four in the P301L-tau mice. Our data also show a significant increase in non-REM bout duration at week four for P301L-tau mice (p = 0.0153), and a trend showing increased non-REM sleep at weeks 8 and 12 in the P301L-tau mice (p = 0.0578). Together, these data show differential effects on sleep parameters at discrete timepoints in the progression of tau pathology.

65. Nate Massa
Major: Chemical Engineering
Minors: Math, Chemistry, Computer Science
Mentor: Dr. Charles Stanier (Chemical and Biochemical Engineering)

Residence Time Distribution in an Oxidation Flow Reactor

Often experimental and industrial processes require the use of a flow reactor through which reactants are turned into products. An important factor in these reactions especially in gas phase or in instances of non-ideal flow is residence time in the reactor. This poster elaborates on how a residence time distribution of a reactor can be found, difficulties in generating an ideal residence distribution, and shows some examples of non-ideal residence distributions generated in lab.

67. Molly Matkovich
Major: Mathematics
Minor: Art History
Mentor: Dr. Gordon Buchanan (Neurology)

The effect of pharmaceutical interventions on epileptic activity and vigilance states in a mouse model of tauopathy

Neurodegenerative diseases associated with the aggregation of hyperphosphorylated tau proteins and subsequent dementia symptoms are collectively deemed “tauopathies.” Memory loss and confusion are
widely recognized clinical indicators of tauopathies. It has been noted that patients with tauopathies such as Alzheimer's disease (AD) and other dementias also experience absence seizures, characterized by spike wave discharges (SWD) on EEG recordings. The contribution of SWDs to the patient’s overall cognitive decline is unknown. Our research aims to demonstrate if anticonvulsants or microtubule-stabilizing agents significantly reduce the number of SWDs experienced in a mouse model of tauopathy. The anticonvulsant Levetiracetam (Keppra) or placebo were administered to tau-aggregating PS19 mice, which are an animal model of frontotemporal dementia. Another cohort of PS19 mice received the microtubule-stabilizing drug Epothilone D (EpoD) or placebo. Both groups were studied and SWDs analyzed, as well as the sleep-wake states during which SWDs occurred. Early data suggest that both pharmaceutical treatments reduce the number of SWDs experienced by PS19 mice and increase the quality of sleep experienced by these mice. This research is expected to advance our understanding of potential therapies to mitigate cognitive decline and sleep disturbances for those experiencing the effects of tauopathy-related dementias.

69. Kelly McDonough  
Major: Speech and Hearing Sciences  
Minor: Psychology  
Mentor: Dr. Si On Yoon (Communication Sciences and Disorders)

Memory for conversation between friends and strangers

Memory is an important part of having a successful conversation with a partner. Previous studies have shown mixed findings of whether partners remember more of what they contribute to an interaction or what their partner contributes. The goal of the current study is to investigate the social effects in conversational memory by comparing memory for conversation between friends and strangers. In the current research, participants had a 15-minutes conversation and then underwent a series of cognitive measures. A free-recall memory task was also completed to examine the participant’s memory for the conversation. Each conversation and the retrieved information were transcribed and broken up into idea units. The results showed that there were a similar number of idea units between both friends and strangers in conversation, although, there was a larger number of turn-taking between friends. Both friends and strangers recalled about 20% of the conversation. Of the memory recall idea units, 62% were considered complete, accurate recalls and 18% were errors. The finding also showed that participants remembered more of what they produced compared to what their partner produced. This finding gives insight to the underlying mechanisms of memory for conversation and reinforces
the impact the generation effect has on memory.

71. Susanna Metcalf  
Major: Psychology  
Mentor: Dr. Katherine Hadlandsmyth (Anesthesia)

Rural Women Veterans with Chronic Pain

In the current study, in-depth qualitative interviews were completed with rural-dwelling women Veterans with chronic pain in order to collect data on pain care services as this sub-set of Veterans with chronic pain are poorly understood and likely unique. The aim of the study was to better define the needs and gaps in care for rural-dwelling women Veterans with chronic pain.

73. Camila Morales  
Major: Communication Science and Disorders  
Minors: Psychology, Social Work  
Mentor: Dr. Bob McMurray (Psychological and Brain Sciences)

Lexical Competition in Second Language Learners: the effect of a carrier sentence

When listeners hear a word, they engage in competition to identify it. For example, when hearing “wizard”, listeners briefly consider similar sounding words like “whistle”, “lizard” and “window” before settling on the correct one. But what about bilinguals? Bilinguals also engage in competition, but it includes words in both languages. For example, when a Spanish listener hears mesa (table), they briefly consider English words like mason. Competition between languages has been observed in bilinguals. This is surprising; even when a bilingual knows the target language, they consider words from both languages. While past work emphasized early bilinguals, less is known about late L2 learners. Thus, we examine both within- and across-language competition in third year Spanish learners. We use eye-tracking to assess competition over the course of milliseconds. L2 learners hear a word like “chalkboard” and view a set of pictures representing words that might be competing (e.g., “chanclas”, “garlic”, and “locker”). As they decide which word they heard, they fixate pictures of words that are under consideration. We investigate lexical competition both within Spanish (e.g., “camiseta” and “cama”) and across languages (e.g., “chanclas” and “chalkboard”). Crucially, we ask whether a carrier phrase, like “select the picture of” increases competition (because of the additional time pressure).
2-Dimensional materials have great potential in electronic and quantum device applications such as FETs, semiconductor waveguides, and high-precision sensors to name a few. One of the most popular methods of selectively exfoliating 2D materials into heterostructures and on top of different substrates is the Semi-Dry Transfer Method. We further developed this method over the course of a whole semester with different techniques and the addition of multiple polymers in the transfer process. Additionally, we show that we are able to create boron vacancies in hBN which lead to optically-active spin defects at room temperature. Our goal is to set up a cavity between a Bragg reflector and a metal to create polaritons, which has great potential in realizing optoelectronic devices and quantum sensors at room temperature.

77. Mitch O'Meara

Major: Human Physiology
Minor: American Sign Language
Mentor: Dr. Jacob Michaelson (Psychiatry)

*Childhood Behavior as an Indicator of Primary Educational Performance*

Individual differences in academic performance arise from a combination of genetic, environmental, and behavioral factors. In childhood, behavioral patterns can be an early indicator for mental health concerns, social functioning, and professional success. However, little is known about when behavioral concerns show the biggest impact on academics. This study aimed to investigate how and when early signs of varying problematic behavior impact academic success. The Childhood Behavior Checklist (CBCL) and Iowa Assessment scores were obtained from a cohort of 261 school-aged children across the state of Iowa. After running statistical analyses on the different sub-sections of the CBCL and Iowa Assessment, the data suggests a moderate association between the academic fields of science and math, with numerous CBCL sub-scales including aggressive behavior, and social problems. Overall, the data shows the strongest association between problematic behavior and academic performance between 5th and 6th grade. Further analysis was conducted by separating the cohort into two groups who either scored above or below the clinically relevant threshold for each CBCL.
sub-scale. The data suggests participants who score in a clinically relevant range in numerous CBCL sub-scales show statistically lower academic scores beginning in 5th and 6th grade compared to their “behaviorally typical” peers.

79. Hannah O’Donnell  
Major: Speech and Hearing Science  
Minors: Psychology, Disabilities Studies Certificate  
Mentor: Dr. Kristi Hendrickson (Communication Sciences and Disorders)

Implications of Word Length on Single-Word Reading

To recognize spoken words, listeners activate multiple similar words that compete for recognition. Words that begin the same (cohorts; e.g. cat and cab) strongly compete early, whereas words that end the same (rhymes; e.g. cat and mat) compete later and to a lesser extent. Moreover, competition changes with word length: bi-syllabic cohorts show decreased competition compared to monosyllabic cohorts, whereas the opposite is true for rhymes (Simmons & Magnuson, 2018). New research suggests written words also compete for recognition (Hendrickson et al., 2021). However, we do not know the nature of this competition because the existing research is limited to monosyllabic words.

In the current study, we use eye-tracking in the Visual World Paradigm (Cooper, 1974), to determine how word length influences competition for written words. Participants read a word and see four pictures (Target [e.g., cat], Cohort [e.g., can], Rhyme [e.g., mat], and an unrelated word [e.g., shoe]), and click the picture of the word they read. Preliminary results show as word length increases, rhyme competition will increase, while cohort competition will decrease. This study has theoretical importance for how written words are recognized.

81. Emma Peters  
Major: Speech and Hearing Science  
Minor: Psychology  
Mentor: Dr. Jean Gordon (Communication Sciences and Disorders)

“How do individuals with aphasia cope with grammar?”

Aphasia is an impairment of language following damage to the brain. Associated with aphasia are two patterns of disordered language production: agrammatism and paragrammatism. Agrammatism is characterized by the omission of small grammatical words (e.g. articles, prepositions) and inflections (e.g. -ing, -ed), resulting in ‘telegraphic’ nonfluent speech (e.g. “you and woman and shoe”). Contrastively, paragrammatism is characterized by the incorrect use of words, resulting
in fluent but jumbled speech (e.g. “she had a ranned from home”). Although agrammatism is well documented, there has been little investigation of paragrammatism; its diagnosis is highly subjective. Thus, we are examining how individuals with agrammatism and paragrammatism differ in their sentence structures. To do this, we analyzed narrative samples from twenty people with nonfluent aphasia (PwNFA) and twenty with fluent aphasia (PwFA). Preliminary results indicate that PwFA used twice as many words in their utterances; however, PwNFA were twice as likely to produce ungrammatical utterances. Furthermore, the grammatical errors of PwNFA were qualitatively different from those produced by PwFA. Ongoing analyses involve exploring the parts of speech used in each group’s utterances. We hope that by better understanding paragrammatism, clinicians will be able to diagnose and treat this disorder more effectively.

83. Delaney Pietzsch
Major: Public Health
Minors: Global Health Studies, Human Relations
Mentor: Dr. Sato Ashida (Community and Behavioral Health)

Experiences of Persons with Dementia and their Caregivers During the COVID-19 Pandemic
This project aims to gain a comprehensive understanding of the experiences of families that provide care and support to older adults who had recently been diagnosed with dementia. As part of the NIH funded intervention research, we conducted interviews with family caregivers to assess their current states including the services they use, their perceptions about caregiving in Iowa, their social support network systems and social interactions with family and friends, and their psychological states (e.g., depression, anxiety, worry about future). My project specifically focused on understanding the experiences of family caregivers of individuals with dementia during the covid-19 pandemic. We characterized the caregivers’ perceptions related to caregiving (self-efficacy and the intent to institutionalize) using the baseline data. Such an understanding can greatly enhance our ability to develop public health strategies to better support families affected by dementia.

85. Jeremiah Poppen
Major: Interdepartmental Studies - Health Science
Mentor: Dr. Erica Teixeira (Operative Dentistry)

Properties of an Adhesive System Loaded with Boron-Nitride Nanosheets
The goal of this project is to create a new dental adhesive mixture that
will last longer than the materials currently used. It is estimated that nearly half of all dental composites will fail in less than 10 years, mostly due to breakdown of the material and cavities around it. If this mixture (adhesive system) is effective, it could mean lower rates of decay, decreased pain, and fewer visits to the dentist.

We hope to accomplish our goals by investigating the effects boron nitride nanosheets (BNNS) have on different properties of the dental adhesive system to determine their effectiveness. BNNS is known to mimic the effects of graphene, including extremely high strength, water resistance, chemical stability, and degradation resistance. It is also colorless and not rejected by the body, making it a promising biomaterial for use in the mouth.

We will conduct several tests to determine how BNNS affects different aspects of the marginal integrity of the tooth. The viscosity, effectiveness of the monomer to polymer conversion, and flexural strength of the systems will be measured. We will also examine how BNNS concentrations affect the long-term absorption of water and the stability of the material bond to the tooth.

87. Marisa Rethman
Major: German, Accounting
Mentor: Dr. Kirsten Kumpf Baele (German)

Anne Frank & The Local Story: Growing With & Learning From Our Jewish Community

This project examines how students in the general education course, Anne Frank and Her Story, at the University of Iowa learn about difficult topics like the Holocaust through service-learning projects to engage with the local Jewish Community. In addition to studying personal narratives from the Holocaust like The Diary of Anne Frank, students in the Anne Frank course assist in the creation of a digital interactive map showcasing significant Jewish locations in Iowa City and Coralville and summarizing their histories. At the end of each semester, students complete a post-experience questionnaire to assess the quality and effectiveness of the service-learning project, using the Service-Learning Benefit (SELEB) scale, as well as evaluate the extent to which the project helped them in reaching their discipline-specific learning outcomes through open questions related to their experiences. This project builds on the theory of embodied pedagogy and aims to evaluate the effect of student embodiment of course concepts on student understanding and engagement. By encouraging students to personalize the past through the collection of local stories, narratives are made more concrete and palatable and subsequently, students' engagement with course topics is increased.
Impacts of the 2020 Midwest Derecho on Cedar Rapids Street Trees

Urban trees, a component of green infrastructure, provide cities with benefits such as climate regulation, stormwater retention, air filtering, noise attenuation, and enhanced human health and well-being. The city of Cedar Rapids estimated that it lost over half a million trees in the 2020 Midwest derecho. Although street trees represent only a portion of the urban forest, their attributes and locations are often stored in an inventory. The Cedar Rapids tree inventory and Linn County census data were entered into a geographic information system (GIS) for spatial analysis and ecological modeling with the i-Tree Eco application. Spatial regression analysis indicates that street trees are unevenly distributed across population densities and income levels in Cedar Rapids, but trends in damaged street trees could not be explained by socioeconomic patterns. Neighborhoods where many street trees were lost may be at risk of an enhanced urban heat island effect and decreased carbon sequestration. Urban trees and replanting schemes should be carefully maintained because thunderstorms like the 2020 Midwest derecho could return sooner than expected.

Quantifying Changes in Lateral and Vertical Hydraulic Gradients for a Shallow Quaternary Aquifer Undergoing Land Use Changes

The Ashton Prairie of The University of Iowa has recently been approved to become a teaching site for various physical science disciplines of the college by being transformed into a restored natural prairie. In order for the site to be used proficiently, a detailed analysis of the site’s groundwater activity, specifically depth and flow direction, are needed in order to understand the impacts of changing conditions on the area's land surface to the associated underlying hydrologic features. To monitor the changing conditions of the site, various groundwater wells were installed across the location to allow for measurements to be taken of the groundwater in order to track their changing conditions over the course of the last seven months. These groundwater level measurements were initially taken by hand, but eventually became manual by the installation of transducers that measured groundwater
depth, as well as barometric pressures of certain wells over three months in five-minute intervals. The data collected from all measurements over the course of the study were then used to create vertical and horizontal gradient models of the groundwater profiles under the surface of the prairie, as well as used to infer the overarching groundwater flow direction. These models demonstrate the changing conditions of the groundwater from fall of 2021 until late winter of 2022. This methodology led to a better understanding of the prairie’s hydrogeologic features in the subsurface.

93. Johanna Theeler  
Major: Biomedical Engineering  
Mentor: Dr. Yusung Kim (Radiation Oncology)

Systematic Review on the Use of Artificial Intelligence in Brachytherapy

This study systematically reviewed literature on the use of artificial intelligence (AI), including deep learning and machine learning, in brachytherapy (BT). Evaluation was performed based on application to BT, disease site, and image modality. Included studies were peer-reviewed journal articles on AI in BT published from 01/01/80 – 08/01/21 on PubMed, Google Scholar, Cochrane Library, and University of Iowa Libraries databases. Studies were searched for application to BT, AI description, plan datasets, input and output of AI, treatment description, ground truth classification, comparison to ground truth, and time for results. This review was performed based on Preferred Reporting Items for Systematic reviews and Meta Analyses (PRISMA) guidelines. A total of 76 studies fit inclusion criteria and scope after an initial yield of 7,488 results from database searches. Studies per application were 21, 17, 6, 7, 14, and 11 for applicator/needle reconstruction, target/organs-at-risk segmentation, imaging applications, dose calculation, outcome prediction, and other planning applications. Studies per disease site were 41, 24, 1, 1, and 9 for prostate, gynecological, breast, choroidal, and no specific or multiple sites. Studies demonstrate that AI has the potential to improve the results and time required for the BT process.

95. Anna Thomas  
Major: Accounting  
Minor: International Business Certificate  
Mentor: Dr. Michael Durney (Accounting)

The Determinants for Private Companies to Amortize Goodwill

This study focuses on how private companies choose to account for goodwill. The purpose of this study is to discover the proportion of private
companies that elect to amortize their goodwill balance and measure the influence of the determinants which drives this election. This paper also aims to identify if private companies generally apply the standard useful life for goodwill. If private companies deviate from the ten-year standard useful life, this study will gather evidence for the reasoning behind the application of a shorter useful life.

97. Dane Tow
Major: Biomedical Science
Minor: Certificate in Clinical and Translational Science
Mentor: Dr. Po Hien Ear (Surgery)

A genetically encoded sensor for studying serotonin metabolism in neuroendocrine cancer

Small bowel neuroendocrine tumors (SBNET) originate from transformed enterochromaffin cells and often hyper-secrete serotonin, resulting in tumor progression and poor quality of life in patients with carcinoid syndrome. Current standard of care drugs have limited efficacy at controlling NET progression and carcinoid symptoms, therefore there are critical needs to identify new medical therapies. Serotonin metabolism presents a promising therapeutic target, yet research in this area has been challenging. Serotonin is difficult to measure, requiring sophisticated mass spectroscopy techniques limited to endpoint data collection. Here we report the development of a novel serotonin-luciferase sensor (iSero-RLuc) for studying serotonin metabolism in real time. The activity of the iSero-RLuc sensor was characterized by luciferase assays in yeast and a NET cell line. Biochemical techniques were used to analyze serotonin’s role in NET cell progression. We report that endogenous serotonin levels in NET cells are significantly increased in an anchorage-independent growth state. Moreover, serotonin was found to support cell survival in this state through transcriptional regulation and altering cell growth. The MAPK/ERK pathway was determined to be a specific point of serotonin regulation and offers a potential therapeutic window that warrants further investigation. In addition, this sensor has potential in vivo applications as a platform for drug discovery and evaluation.

99. Trevor Viohl
Major: Neuroscience
Minor: Human Physiology
Mentor: Dr. Aaron Boes (Neurology, Pediatrics)

Uncovering the Neural Correlates of Executive Function

Lesion-network mapping and measures of network hubness, termed
edge density, have implicated a specific white matter tract, the left arcuate fasciculus, as a significant driver of general intelligence (g). Similar work has shown that g is a critical component of executive function and that both likely share underlying neural correlates. This study aims to evaluate the covariance among the neural constituents of g and executive function with the goal of providing new insight into the neural architecture of executive processes and its translation into a prognostic tool. We assessed the extent to which lesion-overlap within a specific cluster of the lesion-behavior map of g, corresponding to the left arcuate fasciculus, and damage to regions of high edge density, could predict executive impairment among 118 patients with focal lesions due to stroke. This study hypothesizes that patients with lesions that overlap with this select white matter tract and regions of high edge density, will show greater impairment of executive function on neuropsychological tests of executive functioning than those with lesions that do not intersect. Localizing executive processes could guide the course of treatment by predicting the degree of executive dysfunction based on extent of lesion overlap within the left arcuate fasciculus.

101. Rachael Volkman
Major: Neuroscience, Art, Chemistry
Mentor: Austin Bruce, Dr. Kumar Narayanan (Neurology)

6-OHDA mediated dopamine-depletion disrupts temporal encoding in striatal circuits

Time-based decision-making requires nigrostriatal dopamine signaling (1). Striatal medium spiny neurons (MSNs) are strongly modulated by dopamine (2), and MSNs display prominent ‘ramping’ activity during timing tasks (3). Parkinson’s disease (PD) involves the degeneration of dopaminergic nigrostriatal projections, and patients with PD suffer from deficits in temporal processing (4). However, how the dopamine-depleted striatum encodes time remains poorly understood. Here, we lesioned nigrostriatal dopamine projections with focal injections of 6-hydroxydopamine and implanted 4x4 multielectrode arrays targeting the striatum in mice trained to perform an interval timing task. We report 3 main findings. Firstly, the proportion of dorsal striatal MSNs exhibiting ‘ramping’ activity was greatly reduced amongst 6-OHDA lesioned mice compared to saline control mice. Secondly, we report that although MSNs exhibiting “ramping” increased in prominence as mice gained task experience, “ramping” activity remained restricted to a small proportion of 6-OHDA lesioned striatal ensembles, a process which may be related to disrupted procedural learning. Finally, L-Dopa/Benserazide treatment failed to rescue MSN ‘ramping’ activity, suggesting that these dynamics may require phasic dopamine signaling. Our findings may provide explanatory power for PD-related deficits in timing which are resistant to both L-Dopa treatment and deep-brain stimulation (5).
In Vitro Stability of Ghrelin

Cancer cachexia, a multifactorial condition resulting in accelerated muscle wasting, reduces the quality of life of many cancer patients. There is no known cause of cancer cachexia; however, several physiological processes influence muscle/adipose anabolism/appetite. Recently, the administration of ghrelin or anamorelin, a ghrelin receptor agonist, have been of primary interest for treating cancer cachexia. Because of the limited stability of ghrelin, it is considered unlikely to be effective over an extended period. In our experiment, the degradation rate of ghrelin was measured. Recombinant human ghrelin was placed in standard 1.5 mL centrifuge tubes in a 37-degrees Celsius water bath for three weeks, with one sample removed and stored at -80 degrees Celsius each day until analysis. The concentration of intact human ghrelin was measured through an ELISA immunoassay. We hypothesized that ghrelin would be stable inside an isolated system. However, there was no clear pattern of degradation in our in vitro experiment. Although our preliminary data are inconclusive, we anticipate that body temperature alone may impact the stability of ghrelin. As ghrelin and ghrelin-like molecules are being strongly considered as treatment for cancer cachexia, it is necessary to understand the factors influencing the activity of ghrelin through further work.

Using Textual Analysis to Predict Loan Default

The study of human communication has been evolving and growing over time, and has become even more complex with the introduction of technology. Through online communication, people have begun to communicate their messages in ways different than ever before. In this research, we looked at the communication from borrowers’ applications on a peer-to-peer lending site to investigate how borrowers communicated their needs and intentions through their loan application description. We worked to uncover insights into the communication habits of those who pay back vs default on their loan. We used textual analysis methods to process and analyze over 25,000 application descriptions to develop an understanding of what communication factors signal that a person may default on their loan.
Social Cognition in College Students: Associations with Schizotypal Characteristics and Socio-Emotional Functioning

Social cognition refers to the mental operations that underlie social interactions. Social cognitive impairment is a core feature of schizophrenia and may represent an endophenotype. Schizotypal characteristics are associated with vulnerability for schizophrenia, and include positive (e.g., perceptual aberrations), negative (e.g., avolition), and disorganized (e.g., eccentricities) features. Using case-control and correlational approaches, the evidence has been mixed regarding an association between social cognition and schizotypy. Using a cluster analytic approach, we established groups of participants based on similarity of performance across social cognitive tasks and tested the relationships with aspects of schizotypy and socio-emotional functioning in a college student sample (n = 59). We predicted that social cognitive performance would be associated with negative schizotypy, emotional awareness, emotional distress, and social functioning. The final model fit the data well and yielded two groups: one with relatively high (HSC, n = 37) and one with relatively low social cognitive performance (LSC, n = 22). Consistent with predictions, there was a trend for higher negative schizotypy [t(57)=1.81, p=.08, d=.49] and significantly lower emotional awareness [t(57)=3.03, p=.004, d=.74] in the LSC group. Contrary to predictions, the two groups did not significantly differ on emotional distress or social functioning [ps ≥ .60, ds ≤|.14|].
Externalizing problems are burdensome and costly, making efforts to identify targets of intervention for at-risk youth crucial. The aim of this study was to test whether children’s inhibitory control, moderates the well-established association between economic disadvantage and externalizing behavior problems in young children. Research has identified social and environmental protective factors that moderate this association. However, little is understood about child-level processes that mitigate risk of externalizing problems in the face of economic disadvantage. The present study evaluated multiple ecological levels of economic disadvantage, including household-level socioeconomic status and neighborhood-level deprivation. It was hypothesized that inhibitory control would moderate the association between economic disadvantage and externalizing problems across risk contexts. Children ages 3—7 years (N = 102) completed several behavioral tasks assessing their inhibitory control. Caregivers completed questionnaires on their level of economic disadvantage and their child’s externalizing problems. Results revealed that household socioeconomic status predicted externalizing problems in children (β = -.186). Inhibitory control did not moderate the association between economic disadvantage—either in terms of socioeconomic status or neighborhood deprivation—and externalizing problems. Future research should identify modifiable processes that buffer children from the effects of economic disadvantage across ecological levels.

6. Isaac Bills
Major: Sociology
Minor: Political Science
Mentor: Dr. Freda Lynn (Sociology)

Political Beliefs, Networks, and Psychological Welfare: The Consequences of Macro-Level Job Loss in Waterloo, Iowa

During the 1980s, the Farm Crisis and deindustrialization trends resulted in a large number of jobs in the agricultural manufacturing industry being lost. Waterloo, Iowa was a city hit particularly hard during this time, with John Deere getting rid of more than 10,000 workers. I conducted interviews with individuals who were affected by this wave of job losses, including children of affected parents. While there was significant variation between the responses of participants, themes on how the job loss event influenced political attitudes, psychological well-being, and network structure were analyzed. Subjects all reported that their experiences with job loss influenced their political beliefs in some way, though not all were moved in the same direction. Some subjects reported experiencing stigma, while others did not. This is thought to be a result of a social norm effect, which posits that there is less internalization of blame when you interact with people who are also in a
high-unemployment environment. Finally, networks and social capital were still important means of finding new employment, but were generally weakened during the economic crisis.

8. Joshua Brown
Major: Public Health
Minor: Music
Mentor: Amanda Bullert, Dr. Hans-Joachim Lehmler (Occupational and Environmental Health)

*Identifying Neurodevelopmental Impacts of PCB Exposure During Adolescence: Preliminary Findings and the Path Forward*

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.

10. Susanne Byrd
Major: Physics, Astronomy
Mentor: Dr. Zachary Girazian (Physics and Astronomy)

*Characterizing the Induced Magnetic Fields of Mars Upper Atmosphere*

Since 2014, NASA’s MAVEN (Mars Atmosphere and Volatile EvolutioN) spacecraft, which orbits Mars, has been gathering data to observe how solar wind interacts with Mars upper atmosphere and how loss of volatiles has affected its atmosphere and climate historically. The MAVEN data include the first comprehensive observations of the ionosphere of Mars. My research is focused on characterizing the induced magnetic fields of Mars.
IRS1 is dispensable for cardiac fibroblast activation and recovery after cardiac injury

Cardiac fibrosis is the deposition of proteins that normally function to maintain organ structure and aid in wound healing. Fibroblasts are a critical mediator of that process. Excessive fibrosis can contribute to cardiac dysfunction. Additionally, altered insulin signaling and fibrosis are prevalent cardiac-related illnesses such as type 2 diabetes and heart failure. Because IRS1 can regulate fibrotic related signaling molecules such as AKT, ERK, p38, TGF-β, and β-integrins, we hypothesized that signaling through IRS1 will enhance the activation of fibroblasts and the development of fibrosis. To investigate this relationship, we used three different models that lack IRS1: mouse embryonic fibroblasts (MEFs), cardiac fibroblasts, and an in vivo model of cardiac injury. We found that the absence of IRS1 in MEFs led to increased activation and enhanced contraction. Conversely, cardiac fibroblast activation in response to a fibrotic stimulus did not reveal a significant change in response. Furthermore, absence of fibroblast IRS1 in the heart did not affect fibroblast activation or recovery in a model of myocardial infarction. Our data demonstrates that while IRS1 may mediate a response to fibrotic stimuli in some contexts, it does not exert a significant influence on the activity of cardiac fibroblasts and the development of fibrosis.

Nutritional Interventions for Cancer-Related Fatigue

Cancer-related fatigue (CRF) is an extreme form of fatigue and among the most commonly reported cancer symptoms. The mechanism of CRF remains unknown and few pharmacological options effectively manage CRF. Evidence suggests that diet-based interventions may reduce the severity of CRF. The purpose of this project is to create an educational, evidence-based handout for patients with CRF for use in the clinical setting. Methods: Consulting with a health sciences librarian and a cancer-nutrition expert, we searched for research testing the efficacy of diet-based interventions to reduce CRF. Results: Ten research articles were reviewed, and the dietary recommendations with the strongest evidence were the Fatigue-
Reduction Diet, Ginseng, and the Mediterranean Diet. Most of these studies found a need for additional testing in order to evaluate generalizable efficacy and safety.

Conclusions: Research on diet-based interventions for CRF is limited but did show some evidence for the use of ginseng, the Fatigue-Reduction Diet, and the Mediterranean Diet. However, many of the diets studied require access to fresh foods which can be expensive, inaccessible, and/or difficult to prepare. Overall, cancer patients need to collaborate with their healthcare team, including cancer-nutritionists, to determine which nutritional intervention, if any, may be appropriate for them to try.

16. Austin Cook
Major: Biomedical Engineering
Minors: Human Physiology, Math
Mentor: Dr. James Byrne (Radiation Oncology, Biomedical Engineering)

*Copolymeric Matrices in Intratumoral Drug Delivery Systems: A Mechanical Analysis*

Recent developments in biomaterials have brought forth the desire to explore resorbable materials, such as polymers, for drug delivery systems. Through the analysis of key thermo-mechanical properties (e.g., Young’s Modulus, Ultimate Tensile Strength, Melting Point, and Glass Transition Temperature) for selected polymers (polyvinyl alcohol (PVA), polylactic acid (PLA), polyvinylpyrrolidone (PVP), polyglycolic acid (PGA), and polycaprolactone (PCL)) and their copolymer combinations, we have evaluated the capabilities and potentials of these biomaterials as intratumoral drug delivery systems. Analysis of these properties laid a foundation for the potential capabilities and restrictions of these polymeric and copolymeric matrices. Future efforts will focus on evaluating the capabilities of PVA, PLA, PVP, PGA, and PCL in an intratumoral drug delivery system setting.

18. William Dong
Major: Biomedical Engineering
Mentor: Drs. Kanchna Ramchandran (Internal Medicine), Vincent Magnotta (Radiology)

*Safety Testing of a Breast Biopsy Clip in a High-Resolution Neuroimaging Environment*

This research tests UltraCor Twirl, a breast biopsy clip, for safety in a 7 Tesla magnetic resonance (MR) environment at the Magnetic Resonance Research Facility (MRRF) at the University of Iowa. Safety clearance is relevant in allowing patients with the UltraCor Twirl biopsy clip to be scanned in a high-resolution neuroimaging environment for clinical and
research purposes. Safety testing addresses magnetic susceptibility, heating, and artifact properties. Magnetic susceptibility testing includes the translational attraction and torque tests (measurement of force and torque exerted on the biopsy clip due to the magnetic field). The heating test evaluates the temperature change of the clip induced by radiofrequency coils relative to its surrounding environment. The artifact test evaluates the image quality of the biopsy clip in the MR environment by generating two sets of images since metallic clips can cause artifacts (misrepresentation of the imaged object). Magnetic susceptibility testing results indicated no movement of the clip, suggesting that gravity exerted greater force on the biopsy clip than the magnetic field in the scanner. With this partial safety clearance, the heating and artifact tests are still in progress.

20. **Alessandra Dutra**  
Major: Global Health Studies  
Mentor: Drs. Elizabeth Heineman (History), Sokhieng Au (Global Health Studies)

*Comparing the Experience of German and French Sex Workers from 2000-2020*

Germany and France are two of the few countries which have legalized sex work, despite the increasing social approval of a woman exercising her own sexual agency. The issue of sex work and the repercussions of its criminalization are not limited only to those who participate, as the persecution perpetuates constraints on female autonomy and discourages women from exploring their role in sex and their own bodies. Germany and France are two of the few countries where sex work is but have had opposite trajectories over the last 20 years regarding the regulation of the sex work field, as France has increased in restrictiveness and policing. There remains a critical gap in evaluating how the opinion of sex work has changed and been influence by national issues in states which have legalized the occupation. Thus the purpose of this qualitative study is to review primary source information and draw on secondary literature to compare the female sex worker experience between France and Germany. The completion of this project will be overseen by my mentor, Lisa Heinemann.

22. **Jordan Ewald**  
Major: Biomedical Engineering  
Minor: Chemistry, Certificate in Clinical and Translational Science  
Mentor: Drs. Claudia Robles Plannels (Holden Comprehensive Cancer Center), Melissa Fath (Free Radical and Radiation Biology)

*212Pb Targeted Alpha Therapies in Neuroendocrine Tumors*
Abstract: In oncology, targeted therapies are being researched to treat cancer and minimize side effects from systematic administration of anticancer agents. Peptide Radionuclide Receptor Therapy offers the advantage of targeting cell receptors specific to cancer cells, and then delivering a radioactive particle to the cell. To kill the cells, the radioactive particle must emit radiation, and in the case of 212Pb, a combination of alpha and beta particles are delivered. This isotope was bound to Pentixather, a drug that targets the CXCR4 receptor overexpressed in many small-cell lung cancers. This study focused on the therapeutic efficacy of the drug by treating mice with increasing doses of the Pentixather, and assessing the affect on tumor growth after treatment.

24. Elise Femino
Majors: Microbiology, Italian
Mentor: Dr. Mitchell Coleman (Department of Orthopedics and Rehabilitation)

Oxygen Tension is Critical for Oxidative Stress in Articular Chondrocytes in Response to Injury

Arthritis affects 58.5 million people in the U.S., causing debilitating pain and lack of mobility. Osteoarthritis after articular injury has been shown to depend upon mitochondrial oxidative stress. Our aim was to examine the oxidative stress in articular cartilage after a well-characterized mechanical injury at the atmospheric oxygen tension of 21%, compared to the 5% found in physiological niches. We hypothesized that 21% oxygen would lead to more severe oxidative stress after injury. To test this, we used a bovine osteochondral explant model with either a sham or energy-controlled 2 J/cm2 impact. After injury, samples were incubated at 37C under their designated oxygen tension and oxidative stress was assessed. Intracellular 3-nitrotyrosine formation, which can result from free radical production, was increased in atmospheric oxygen as was oxidation of glutathione, a key intracellular, thiol-based antioxidant. This result was confirmed via live cell confocal microscopy using monochlorobimane, which stains reduced thiols. Disturbances in each of these redox endpoints were observed basally and after impact. These results support the hypothesis that physiological oxygen tension is critical for modeling chondrocyte biology in culture.

26. Lauren Fergus
Majors: Biomedical Sciences, Microbiology
Minor: Certificate in Clinical and Translational Sciences
Mentor: Monica Hall, Dr. Carla Nester (Pediatrics)

Pregnancy Outcomes in C3 Glomerulopathy
C3 Glomerulopathy (C3G) is a glomerular disease characterized by
underlying dysregulation of the alternative complement pathway. Most patients approach end stage kidney disease within ten years of diagnosis. Recurrence in renal transplants is high. Little is known of the role of pregnancy in the natural history of C3G, and whether a coincident diagnosis affects comorbidities or maternal-fetal outcomes. Female subjects in the University of Iowa’s C3G Natural History Study who met consensus biopsy criteria and had at least one pregnancy were included in the cohort (n=17). Clinical and lab data, including genetic and acquired drivers of disease studies were assessed. Standard peri-pregnancy outcomes were considered. Our data supports an increased risk of preeclampsia in C3G mothers as compared to healthy mothers. There was no excess risk of miscarriage, cesarean section, ectopic pregnancy, prematurity, or low birth weight. This data indicates a relatively higher risk of preeclampsia and lower risk of cesarean section compared to women with IgA Nephropathy, a similar chronic kidney disease. A similar risk of miscarriage, prematurity, and low birth weight compared to other glomerular diseases was evident. Our data supports a reasonable maternal-fetal risk profile for C3G patients.

28. Hope Fury  
Major: Biomedical Sciences  
Minors: Spanish, Clinical & Translational Sciences  
Mentor: Dr. 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.
30. Maunika Gandhamaneni  
Major: Chemical Engineering  
Mentor: Dr. Daniel Weeks (Biochemistry and Molecular Biology)

Identification of Protein Features That Direct Compartmentalization in the Nucleolus

The nucleolus is a non-membrane-bound organelle that is responsible for ribosome assembly and rRNA synthesis. Hundreds of proteins are involved in the production of ribosomes, and many of these proteins are concentrated by phase separation in the nucleolus. The nucleoli have three spatially distinct compartments that perform different functions that are involved with ribosome biogenesis: the fibrillar center (FC), dense fibrillar component (DFC), and the granular component (GC). The FC is responsible for rRNA synthesis, the DFC is responsible for rRNA modification, and the GC focuses on ribosome assembly. Here, we seek to understand why some proteins partition into one compartment instead of another. To understand this phenomenon, we used Xenopus laevis oocytes. We tested if the intrinsically disordered domains (IDD) found in proteins specific to either the GC or DFC provided sufficient information to establish nucleolar compartment localization. We also examined whether disrupting protein-protein interactions of a complex that typically localizes to the DFC changes a protein’s compartment localization. We found that disrupting protein-protein interaction did not prevent trafficking to the nucleolus but did influence protein compartmentalization.

32. Will Golay  
Majors: Astronomy, Physics  
Minor: Mathematics  
Mentor: Drs. Robert Mutel, Caroline Roberts (Physics and Astronomy)

A search for thermal gyrosynchrotron emission from hot stellar coronae

We have conducted a search for thermal gyrosynchrotron radio emission from a sample of eight radio-loud stars whose X-ray coronae contain a hot thermal component. We used the JVLA to measure Stokes I and V/I spectral energy distributions (SED’s) over the frequency range 15--45~GHz, fitting for best-fit models parameters using both power-law and thermal gyrosynchrotron emission models. For the three chromospherically active binaries (Algol, UX Arietis, HR1099), the SED's were well-fit by a power-law gyrosynchrotron model, with no evidence for a thermal component. The SED's of the three M-dwarf flare stars (AD Leo, YZ CMi, UV Ceti) were also fit with power-law models, albeit with higher scatter, but little evidence for a thermal component. However, for the two weak-lined T Tauri stars (V410 Tau, HDE 283572), the SEDs had
a circularly polarized enhancement above 30~GHz that was inconsistent with a pure power-law electron distribution. These spectra were well-fit by summing the emission from an extended coronal region with power-law gyrosynchrotron emission and a smaller region with hotter thermal plasma and much stronger magnetic fields emitting thermal gyrosynchrotron emission. The inferred magnetic fields range from 1000 -- 2500~gauss in these hot coronal regions.

34. Bryan Guevara  
Major: Biology  
Minor: Environmental Science  
Mentor: Dr. Maurine Nieman (Biology)  

*Identifying the genetic basis of a rare sinistral phenotype in a right-coiling snail*

Potamopyrgus antipodarum is a freshwater New Zealand mud snail that is known for its invasiveness. This snail is known to be directionally asymmetrical and dextral (right-coiling). An undergraduate discovered a sinistral (left-handed) snail a few years ago. We are now doing genomic research to uncover what genes are the cause for this change in directionality. We are focusing on assembling the sinistral snail's genome to compare it to its clonemates' genomes and our reference genome. This means we have to assemble the sinistral snail's genome as well as the genome of its clonemates. Our reference genome is already high-quality and annotated. We have used a phenol-chloroform DNA extraction method to extract DNA from our sinistral snail and its clonemates. Afterward, generations of genome libraries were made for each individual. We have now sequenced each genome and are working to filter out poor sequence reads to produce our high-quality genome by utilizing the already annotated Potamo genome to accurately assemble the new genomes.

36. David Hebrink  
Major: Environmental Science  
Minors: Geographic Information Science, Business  
Mentor: Dr. Rebecca Kauten (Geographical and Sustainability Sciences)

*Milford Creek Urban Pollutant Point and Nonpoint Source Analysis: A Comparative Retrospect*  
This project combines geospatial analysis of public data and local water quality data to evaluate results of a nearly twenty-year-old watershed plan. A 2007 total maximum daily load (TMDL) for the lower reach of the Milford Creek watershed cites excessive amounts of algae present in the stream leading to violations of the state’s water quality standards for dissolved oxygen related to diurnal fluctuations. Suggested water quality improvements include “significant” reductions in phosphorus loading
from point and nonpoint sources including agricultural and urban land use.
This project incorporates the Source Load Assessment & Management Model (SLAMM) in an ArcGIS interface to estimate pollutant load from urban areas, and compare results with 2005 data. Dissolved phosphorus measurements from the time series were also compared with sample data from 2021 and with data from a watershed under similar conditions in central Iowa. Results indicate an increase in both urban and agricultural land use, particularly from 2008-2011. SLAMM modeling data produced a comparatively different output than models designed to estimate pollutant load from agricultural land use only. By combining these models, this study provides a more complete assessment of actual conditions in the watershed both historically and at the present time.

38. Allyson Herman
Major: Business Analytics and Information Systems
Minors: Sport and Recreation Management, Certificate in Interscholastic Athletic Administration
Mentor: Dr. Kristina Bigsby (Business Analytics)

*The Relationship Between Socioeconomic Status, Swimming Lesson Access, and Drowning Rates in the Midwest*

Drowning is the third leading cause of unintentional death in the world according to the World Health Organization. This study examines the relationship between socioeconomic status, proximity to swimming lessons, and drowning rates in each county across the 12 midwestern states. A custom dataset was constructed by integrating information on drowning deaths and poverty statistics in 1,054 counties from the Centers for Disease Control and the United States Census Bureau, as well the locations of 316 swim lesson providers collected from the American Red Cross and other sources. Statistical analysis of this data was performed, including correlation testing, hypothesis testing, and regression. Results indicated a positive correlation between county-level drowning rates and poverty rates ($p = 0.01646$ when $H_0 =$ relationship between drowning and poverty). Although more research is required, initial findings suggest a heightened need for public education on drowning risks and water safety in lower-income areas.

40. Bailey Hollis
Major: Human Physiology
Minor: Pre-Med Track
Mentor: Dr. Li-Chun (Queena) 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 the 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.

42. Allysa Jones
Major: Neuroscience
Mentor: Dr. Gordon Buchanan (Neurology)

Effect of serotonergic activation in the DRN on maximal electroshock seizure survival

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 after a seizure may be involved. The dorsal raphe nucleus (DRN) promotes arousal and contains serotonin (5-HT) neurons. Previous research indicates that optogenetic activation of 5-HT neurons in the DRN reduces postictal generalized EEG suppression (PGES). We hypothesized that activating 5-HT neurons in the DRN in the same manner would increase survival in mice undergoing a maximal electroshock seizure (MES). TPH2-ChR2-YFP and WT mice were implanted with EEG/EMG electrodes and a fiberoptic into the DRN. 5-HT neurons in the DRN were activated with 473 nm light (4 Hz, 10 mW) for 5 minutes before MES induction with 50 mA stimulation. Survival, seizure duration, seizure severity, and PGES were measured. We found that pre-seizure activation of 5-HT in the dorsal-medial DRN prevented death in the TPH2-ChR2-YFP mice without affecting seizure duration or severity. These results suggest that this network is important for SUDEP prevention. Future studies will use anterograde and retrograde tracing to determine which neurons the DRN projects to and what neurons are projecting to the DRN.
**44. Jivan Koneru**  
Major: Biology  
Mentor: Dr. Renata Pereira (Internal Medicine)

The protein kinase R (PKR)-like endoplasmic reticulum kinase (PERK) is required for thermogenic activation of brown adipocytes.

Thermogenic activation of brown adipocytes is important for heat production and maintenance on energy homeostasis. Our preliminary data demonstrated that induction of the activating transcription 4 (ATF4), the transcriptional effector of the integrated stress response (ISR), is required for thermogenic activation of brown adipose tissue (BAT); therefore, we hypothesized that the ISR kinase protein kinase R (PKR)-like endoplasmic reticulum kinase (PERK), which is upstream of ATF4, is required for adrenergic stimulation of brown adipocytes. To test our hypothesis, we generated brown adipocyte-specific PERK knockout (KO) mice. PERK KO and littermate wild type (WT) control mice were injected with the β3 adrenergic receptor agonist CL 316243 (CL) or vehicle (saline) for 5 days to stimulate thermogenic activation of BAT. Our data demonstrated that the CL-induced rise in core body temperature was blunted in PERK KO mice. Furthermore, protein levels of thermogenic markers such as uncoupling protein 1 (UCP1) and peroxisome proliferator-activated receptor gamma coactivator 1-alpha (PGC-1α) were reduced in BAT of PERK KO mice in response to CL treatment. Finally, CL-induced UCP1-dependent mitochondrial respirations were markedly reduced in PERK KO mice. Taken together, our data demonstrates that PERK is required for β3 adrenergic-mediated thermogenic activation of brown adipocytes in mice.

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**46. Sreelekha Kundu**  
Major: Microbiology  
Minor: Sociology  
Mentor: Dr. Hanna Stevens (Psychiatry)

*Vines of Love: From Bench to Motherhood*

In the Stevens’ lab we study the relationship between maternal stress and offspring neurodevelopment. We identify potential variations in molecular and cellular aspects of offspring brain and placenta development and investigate how these changes may be related to psychiatric disorders. Maternal stress can come in various forms such as psychological stress (anxiety or depression), environmental stress (pollution), illness (preeclampsia) and more. Our research has shown that maternal stress can be linked to improper offspring neurodevelopment as well as improper placental development. Inspired by the data showing strong impact of maternal stress on fetal development, we wanted to find
a way to encourage expectant and new mothers to alleviate the maternal stressors that can be somewhat controlled, such as maternal mental health, or the psychological stress that new or expectant mothers may face. We developed a baby book that holds a special message for new mothers, encouraging them to seek help if they feel troubled by strong and unfamiliar emotions. This book is expected to be given to new mothers at UIHC.

48. Quinn Mattison  
Major: Biochemistry  
Mentor: Dr. Daniel Weeks (Biochemistry and Molecular Biology)  
*The localization and activity of the RuvB complex formed by RuvBL1 and RuvBL2 in the Xenopus laevis nucleus*

The RuvB complex is formed by several proteins, including RuvBL1 and RuvBL2, and is known to have chaperone activity. We examine the aggregation properties of the RuvB complex and how these aggregation properties are affected by introducing a dominant-negative mutation. We checked for aggregation in the nucleus of Xenopus laevis oocytes for both RuvBL1 and RuvBL2 along with its dominant-negative mutations. Additionally, we tracked the development of embryos with wild type versus mutated RUV). The hypothesis is that by introducing dominant-negative mutations to RUVBL1 and RUVBL2, the localization and development of these proteins will be affected.

50. Hailey McCoy-Munger  
Major: Biomedical Engineering  
Mentor: Dr. Lori Wallrath (Biochemistry)  
*A Fruit Fly Model of the Rare Vision Disorder Retinitis Pigmentosa*

Retinitis pigmentosa (RP) is a rare human vision disorder that causes progressive retinal degeneration due to death of photoreceptors and can lead to complete blindness. Mutations in the gene SNRNP200 encoding a pre-mRNA splicing factor cause RP. A patient with clinical presentations of RP was found to have novel genetic mutation in SNRNP200. Utilizing the model organism Drosophila melanogaster—the fruit fly—the patient’s mutation and a known RP-causing mutation were individually made in the fruit fly Snrnp200 gene. Genetically modified third instar larvae showed increased cell death in eye imaginal discs. RNAi knockdown of Snrnp200 in the fruit fly eye caused a rough eye phenotype, indicative of death of photoreceptors. RP is associated with increased oxidative stress; thus, antioxidants are a potential avenue to investigate for treatment of eye defects associated with the disease. The fruit fly models provide the opportunity to test compounds for correction of the defects. Flies harboring the rough eye phenotype will be treated
using two powerful antioxidants, N-acetylcysteine and curcumin, and examined for correction of the eye defects.

52. Tristan McMillan
Majors: Physics, Chemistry
Mentor: Dr. Thomas Folland (Physics and Astronomy)

*Development and Application of an Infrared Microscope to Determine Temperature Dependent Properties of Materials*

IR spectroscopy is the usage of infrared light- light of wavelengths between 700nm to 1mm- to analyze the properties of materials. IR spectroscopy is more famously used in organic chemistry as a diagnostic tool, but is also used in condensed matter and materials physics determine the photonic behavior of different materials, such as semiconductors and 2 dimensional materials. Two dimensional materials are materials with crystalline structures only a few atoms thick, and with weak out-of-plane interactions but strong in-plane interactions. Because most 2 dimensional materials cannot be fabricated as perfect bulk crystals of macroscopic size, IR analysis of these materials must be done at microscopic sizes, necessitating an specialized IR microscope. Due to the limitations and expenses imposed by commercially available infrared equipment, research into the temperature and thickness dependent properties of 2 dimensional materials necessitates the production of a custom built cryogenic infrared microscope. This custom microscope needs to be developed using widely available parts, broadband for multiple possible use cases, use an incoherent thermal light source, and be simple enough to be assembled without expertise due to the lack of documentation in this area.

54. Manisha Modukuri
Major: Psychology
Minors: Human Relations, Social Justice
Mentor: Bengti Baran (Psychological and Brain Sciences)

*Can poor sleep quality lead to increased psychiatric risk of higher depressive symptoms, anxiety symptoms, and increased emotional eating?*

Sleep disturbances can lead to irregulation of sleep rhythms in sleep wake cycles, resulting in poor sleep quality. We developed an online Qualtrics survey to measure the relationship between self-reported sleep, mood, and psychotic symptoms and eating habits. The survey scales used in this study were: PSQI (Pittsburgh Sleep Quality Index), ASI-3 (Anxiety Sensitivity Index, QIDS (Quick Inventory of Depressive Symptoms) TFEQ (Three Factor Eating Questionnaire)- specifically the
Emotional Eating Component. We found that between the PSQI total global score and the QIDS total score, and TFEQ Emotional Eating component total score, all the p-values were statistically significant, and that between the PSQI total global score and the QIDS total score, ASI-3 total score and TFEQ Emotional Eating component total score, there were positive correlations between the scores. Participants that scored low on the PSQI global scores were associated with experiencing poor sleep quality and were also correlated with having higher ASI-3, QIDS, and TFEQ Emotional Eating scores, demonstrating that poor sleep quality can lead to increased psychiatric risk of higher depressive symptoms, anxiety symptoms, and increased emotional eating.

56. Jolee Mohr  
Major: Civil Engineering  
Minor: Certificate in Sustainability  
Mentor: Dr. Robert Bork (Art and Art History)

Producing laser-based graphics of Reims and Metz Cathedrals

Reims and Metz Cathedrals were both begun in the thirteenth century, and they rank as two of the largest Gothic cathedrals in Europe. Gothic cathedrals were designed geometrically, using simple tools such as the compass and the straightedge. For most medieval buildings, design drawings did not survive. In order to analyze the geometry of Reims and Metz, proper scans are necessary. With the blessing of the French government, measured scans were captured in 2018 by a team led by Dr. Bork from the University of Iowa and Pierre Hallot from the University of Liège, Belgium. Even after integration of the resulting point cloud data, however, visualization of the cathedrals’ stone surfaces was difficult. In this ICRU project, therefore, the laser scan data was transformed into opaque 3D models utilizing a combination of ReCap and Revit design software. Experimentation with the models led to optimizing the point clouds and cleaning the data to focus closer on the visualization of the structure. Utilizing selection boxes and related tools to zero in on the relevant sections and levels has resulted in beautiful and sharply rendered images that can be studied easily even in a small laptop CAD system.

58. Alexis Oppman  
Major: Biomedical Sciences  
Mentor: Dr. Chad Grueter (Internal Medicine)

Investigating the Therapeutic Potential of Cdk8 Small Molecule Inhibitors to Prevent Pathological Cardiac Remodeling and Heart Failure
Pathological cardiac hypertrophy represents a major risk factor for heart failure. Cardiac hypertrophic responses are coordinated in part through altered transcriptional dynamics involving chromatin accessibility, transcription factor (TF) activation, and enhancer utilization. Recent studies are investigating the therapeutic potential of transcriptional machinery in regulating cardiac pathogenesis. Mediator is a multiprotein complex that integrates signal-dependent TFs with basal transcriptional machinery to regulate downstream gene expression. Cyclin-dependent kinase 8 (Cdk8) is a Mediator kinase demonstrated to have a complex role in transcription regulation. Cardiomyocyte-specific Cdk8 overexpression leads to cardiac hypertrophy consistent with HF, suggesting that Cdk8 activity may play a significant role in heart disease progression. To investigate the cardioprotective potential in regulating Cdk8 activity, we used selective inhibitors CCT251545 and Senexin A in an in vitro neonatal rat cardiomyocyte hypertrophy model and CCT251545 in an vivo angiotensin II-induced hypertensive mouse model. It was hypothesized that Cdk8 inhibition would lead to reduced hypertrophic responses. Results indicate that CCT251545 and Senexin A are effective at inhibiting Cdk8 activity, leading to blunted hypertrophic responses with altered gene expression. These studies demonstrate a role for Cdk8 activity in transcriptional regulation of genes associated with pathological cardiac hypertrophy.

60. Maddie Pallardy
Major: Management
Mentor: Dr. Eean Crawford (Management and Entrepreneurship)

Relationship Quality and Conflict Management

My research focuses on how employees react to a manager’s conflict management style given the quality of the manager/employee relationship. First, I will analyze how conflict management outcomes impact an employee’s feelings/perceptions toward the organization. Next, I will determine if the quality of the manager/employee relationship changes the employee’s reaction to the manager’s conflict handling style. Specifically, I want to know how relationship quality affects the influence of a manager’s conflict handling style on employee job satisfaction and performance. We will be collecting data via online surveys from full-time managers and their employees about their perceptions of workplace satisfaction, performance, conflict management, and relationship quality.

62. Isa Perales
Major: Biochemistry
Mentor: Dr. Pam Geyer (Biochemistry and Molecular Biology)

Structural changes in centrosomes correlate with activation of a
Homeostasis of Drosophila germline stem cells (GSCs) depends upon the integrity of the nuclear lamina (NL). Indeed, loss of the NL protein emerin blocks germ cell differentiation and causes GSC death due to activation of two DNA damage response kinases ATR and Checkpoint kinase 2 (Chk2). Previous studies suggested that checkpoint activation in emerin mutants results from a thickening and lobulation of the NL, due to insertion of enlarged interphase centrosomes that carry excess pericentriolar material (PCM). To understand whether NL distortion or centrosome structure is the primary activator of the checkpoint, we used the Gal4-UAS system to overexpress two NL proteins, the inner nuclear membrane protein Kugelkern (Kuk) and the A-type lamin (Lamin C), chosen based on previous findings that their increased accumulation caused NL distortion. Although over-production of both proteins was achieved, only Kuk caused NL deformation in GSCs. Whereas Kuk overexpression caused NL distortion, interphase centrosome structure was unaffected. Notably upon Kuk overexpression, GSCs were maintained and oogenesis was sustained. Based on these findings, we conclude that NL distortion alone is not sufficient for activation of the ATR/Chk2 checkpoint. Instead, our findings suggest centrosome structural changes might drive checkpoint activation in GSCs.

64. Olivia Peters  
Major: Human Physiology  
Minor: Art  
Mentor: Dr. Mark Santillan (Obstetrics and Gynecology)

**Machine Learning Predicting Poor Pregnancy Outcomes**

The placenta is an organ that proliferates during pregnancy to supply the fetus nutrients via the umbilical cord. Blood flow through this umbilical cord can be monitored for proper placental function using an ultrasound of the umbilical artery. Proper placental function is important for avoiding poor pregnancy outcomes, such as low birth weight and prematurity. For those situations in which placental blood flow is poor, the doctor must decide the best time to deliver the baby based on the information provided by the ultrasound. Unfortunately, current ultrasound data analysis proves to be somewhat arbitrary in this choice. The purpose of this project is to develop a Machine Learning program which will explore further information mining from these ultrasounds. The hope is to provide doctors with a more concrete outlook to help them make informed decisions that will provide the safest birthing experience. Currently in this investigation, the AI algorithm is being developed and a cohort of data for processing is being collected.
66. Josh Peterson  
Majors: Biology, Biochemistry  
Minor: Chemistry  
Mentor: Dr. Marcelo Correia (Internal Medicine)

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

Previously we have investigated the effects of a skeletal muscle specific knockout of dynamin-related protein-1 (DRP1 KO) in C57 mice. DRP1 KO mice are resistant to weight gain induced by high fat diet related to a reduction in adipose tissue and are more tolerant to glucose. DRP1 KO mice also have elevated levels of GDF15 and FGF15, which we hypothesized was downstream from an increase in endoplasmic reticulum (ER) stress. To test this hypothesis, we chronically treated wildtype and DRP1 KO mice with tauroursodeoxycholic acid (TUDCA), which is a bile acid that has been shown to alleviate ER stress. As opposed to the anticipated results, TUDCA did not rescue the weight phenotype in DRP1 KO mice and indeed substantially protected wild-type mice from weight gain and glucose intolerance associated with high fat diet for 10 weeks. We now hypothesize that ER stress might have a bidirectional effect on weight and glucose homeostasis. It is possible that different pathways of the ER stress response might have a different impact on adiposity regulation.

68. Cade Rahlf  
Major: Biochemistry  
Mentor: Dr. Madeline Shea (Biochemistry)

*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 that binds the NaV IQ motif, and intracellular fibroblast growth factor homologous factors (FGFs) that bind the NaV EF-hand like domain (EFL). Both auxiliary proteins regulate NaV inactivation.

We discovered two sites in the N-terminal domain (NTD) of A-type FGFs (FGF11A, FGF12A, FGF13A, and FGF14A) which 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 with PrDOS, Robetta, PyMOL, and Yasara predict these sites adopt helical secondary structures within a larger intrinsically disordered region and may pack against the FGF core.

We hypothesize that CaM binding to CaMBD, the higher affinity site,
releases the LTP to contribute to NaV inactivation by blocking the pore and stopping Na+ influx. To visualize possible states of this 3-protein complex, we are using structural and hydrodynamic studies (NMR, crystallography, DLS, and analytical chromatography). To understand calcium-induced switching in this allosteric network, we are conducting titrations monitored by steady-state fluorescence spectroscopy to determine differences in the effects of A-type FGFs on CaM bound at the IQ motif, and CaM bound to the FGF NTD.

70. Ashley Rhodes
Major: Biomedical Engineering, Human Physiology and Pre-Law
Mentors: Emily Witt (Radiation Oncology), Dr. James Byrne (Radiation Oncology, Biomedical Engineering)

Dissolution Kinetics of Solid Gas Entrapment Materials

According to the Centers for Disease Control and Prevention, it is estimated that 13% of all men will get prostate cancer in their lifetime, and 3% will succumb to the disease. Prostate tumors have been shown to be hypoxic, which influences the effectiveness of anti-cancer therapy. The use of hyperbaric oxygen or oxygen donors in animal models bearing tumors has been shown to improve response to standard-of-care treatment methods, such as radiation therapy. We have developed a class of gas entrapment materials (GEMs) that can be administered directly into the tumor to deliver oxygen gas. These materials are hygroscopic and need to be encased to prevent premature release of the entrapped gas. To prolong dissolution, we have identified a series of biocompatible, hydrophobic fluorinated polymers to coat the GEMS. We then tested the dissolution kinetics of GEMS with single versus multiple coatings. We found that higher concentrations of the fluorinated polymer for dip coating of the GEMS and an increased number of coatings resulted in longer dissolution times. In the future, we plan to evaluate the efficacy of the GEMs in tumor-bearing small animal models.

72. Mackenzie Richardson
Major: Biomedical Engineering
Minor: Math
Mentor: Dr. James Byrne (Radiation Oncology, Biomedical Engineering)

Establishing Electrical Signals of Tumor vs Healthy Tissue Using a Potentiostat

Testing different types of tissues is oftentimes invasive and uncomfortable. Utilizing electrochemical equipment, such as a potentiostat, would be less invasive and more effective. A potentiostat
sends electrical impulses into tissues and presents a reading, like a signature for the tissue, in the form of a graph to display this data. The goal of this project is to use a potentiostat to distinguish between various kinds of tissues. Some testing has been done to show the difference between animal muscle types, such as skeletal and smooth muscles. Future plans are to test tissues from the human body and suggest a prototype for a handheld device could be made to bring into medical procedures.

74. **Dalton Rippey**  
Major: Chemistry, Sociology  
Mentor: Leah Scharlott, Dr. Nicole Becker (Chemistry)

**Phenomena-Based Learning in College Chemistry: Doing to Understand vs Doing to Do**

The work of practicing scientists often involves explaining how and why observable events occur, therefore it’s important science instruction prepares students to do the same. Reforms in science education are looking for ways to increase this approach to learning within classrooms, one of which is the Next Generation Science Standards (NGSS) for K-12 level education. Phenomena-Based Learning, a critical feature of the NGSS, describes a unique approach to challenging students to think and describe events in the real world by presenting them with macroscopic observable examples that help them to picture, interpret, rationalize, and explain the concept at hand. Currently, there are only studies focused on the K-12 level of learning and little is known about how it could be applied to postsecondary courses such as general chemistry. This study examines how instructors from three college level general chemistry courses incorporate and demonstrate Phenomena-Based Learning within their classrooms. The findings can help to show the benefits and shortcomings of transitioning this style of learning into postsecondary college chemistry courses.

76. **Taylor Saluri**  
Major: Nursing  
Minor: Physical Activity and Nutrition Sciences  
Mentor: Drs. Ruth Grossman, Theresa Bechtel (Nursing)

**Undergraduate Nursing Education: Impact of Poverty Simulated Experiences on Increasing Nursing Students’ Empathy and Awareness**

Poverty is an influential social determinant of health that affects 10% of the global population. It negatively impacts every aspect of life and produces detrimental health outcomes (WHO, 2019). Negative poverty
stigmas and lack of public assistance creates a self-perpetuating poverty cycle, making poor individuals more vulnerable. Thirty-five percent of nurses believed that homeless people earned an adequate living from government benefits (Price et al., 1989). Negative attitudes towards patients living in poverty adversely influences quality of care. To provide equitable care, nurses must be aware and empathetic of poverty’s impact on the lives and health of patients. The purpose of clinical poverty simulations is to increase nursing students’ understanding and awareness of the relationship between poverty and health. Through simulation students experience a realistic and amplified representation of potential situations in a safe learning environment. Participation in simulated poverty interventions has been demonstrated to provide valuable insights about living in poverty and facilitates improved attitudes towards poverty, increases empathy, and sensitivity towards individuals affected by poverty (Thompson, 2019). The goal of this project is to determine the impact of the Community Action Poverty Simulation (CAPS) on undergraduate nursing students at the University of Iowa utilizing a pre/post survey.

78. Emma Schopen
Major: Environmental Science
Minor: Geographic Information Science
Mentor: Dr. Elizabeth Stone (Chemistry)

*Tracking the Spatial Distribution and Variability of Pollen Concentrations in Eastern Iowa using Passive Samplers*

Pollen particles are a cause of health issues for individuals with allergies and sensitive respiratory systems. By understanding the spatial variability of pollen concentrations across different landscapes we can make better and more accurate predictions about pollen exposures. In this study, airborne pollen was collected using passive samplers during ragweed season. Pollen number and diameter were measured. With this information, we calculated the pollen settling velocity to assess the concentration. The data presented correspond to August 9-22, 2021 and local environments of forests, prairies, and developed areas. We have observed so far that the samples collected across the different landscapes are varied with concentrations from 27.6 to 2129 pollen grains per cubic meter of air. When compared to the National Allergy Bureau scale for daily measurements of weed pollen, the observed concentrations were considered to fall in range of moderate to very high. For the future, another period of samples will be processed to see how the variability changes over the summer. Also, concentrations will be compared to the features of the landscape they were taken from to see if different landscapes affect pollen concentrations differently.
80. Katie Sheehan  
Major: Medical Laboratory Science  
Mentor: Dr. Luke Wiley (Ophthalmology and Visual Sciences)

*Characterization of a novel Pde6b-deficient rat model of retinal degeneration and treatment with cGMP-grade AAV vectors.*

The purpose of this study is to characterize a novel rat model of Pde6b-associated retinal degeneration and test the ability of clinical-grade AAV vectors to deliver human PDE6B to rat photoreceptors and mitigate disease. Pde6b-null rats were generated on a Sprague-Dawley background via CRISPR-Cas9 genome editing. Animals were evaluated at post-natal days 14 (P14), 30, 60 and 90 via immunohistochemistry with histological quantification of outer nuclear layer (ONL) cell density and thickness at each time point. For gene augmentation experiments, Pde6b-null animals received a single subretinal injection of either AAV2/1-PDE6B or AAV2/5-PDE6B into one eye. A cohort of wild-type animals were also treated with each vector to confirm delivery. ONL measurements were compared in a masked fashion to avoid bias. Compared to wild-type, Pde6b-null animals displayed early onset and rapid photoreceptor degeneration that resulted in near complete loss of photoreceptors by P60. Delivery of AAV2/1-PDE6B or AAV2/5-PDE6B to wild-type rats showed that AAV2/1-PDE6B drives more human PDE6B than AAV2/5-PDE6B. In Pde6b-null rats, eyes that received AAV2/1-PDE6B displayed a delay in photoreceptor loss compared to buffer-treated controls and eyes treated with AAV2/5-PDE6B. The Pde6b-null rat is ideal for evaluating gene augmentation vectors and autologous stem cell-mediated photoreceptor replacement.

82. Abbi Shekleton  
Major: Speech and Hearing Science  
Mentor: Dr. Si On Yoon (Communication Sciences and Disorders)

*Sensitivity to the discourse history in older adults: Evidence of lexical differentiation*

Speakers are sensitive to the discourse history and distinguish new discourse referents from non-present referents discussed in a previous context. For example, speakers tend to elaborate the referring expression with a modifier, e.g., the open umbrella, if a different exemplar from the same category had been mentioned in the past, e.g., the umbrella. Little is known about older adults’ sensitivity to discourse history who experience memory decline as a result of cognitive aging. Here, we examined the phenomenon of Lexical Differentiation across the lifespan by comparing the referring expressions between the younger and older adult populations. 32 younger adults and 32 older adults completed a
referential communication task. Participants viewed 4 pictures on the screen and described the target image for the experimenter. In the task, on critical trials, a target referent (e.g., open umbrella) was from the same category as an earlier exemplar (e.g., closed umbrella; differentiation condition) or from a different category (e.g., closed bottle; non-differentiation condition) that had previously been described. We find that younger adults generally produced more modification in filler trials, but a robust differentiation effect was evidenced by both younger and older adults by increased use of modifiers at critical trials in the differentiation vs. non-differentiation condition. Both groups differentiated between the current target image and the previously described image.

84. Bhavana Sirimalle
Major: Microbiology
Minor: Medical Anthropology
Mentor: Dr. Toshihiro Kitamoto (Anesthesia)

*Suppression of seizures in fruit flies by genetically modified innate immune cells*

Local and systemic interactions between the nervous and immune systems play dynamic and complex roles in various physiological and pathological processes. A basic understanding of the biology of functionally important neuroimmune interactions is of scientific and clinical significance. The current project originates from our discovery in the fruit fly Drosophila melanogaster that loss-of-function mutations in glutathione-S-transferase S1 (GstS1) lead to significant suppression of seizure-like phenotypes caused by paraShu, a gain-of-function mutation in the voltage-gated sodium channel gene, paralytic (para). In this study, we found that knocking down GstS1 specifically in hemocytes (Drosophila blood cells) recapitulates the effect of GstS1 mutations, resulting in reduced seizure severity in paraShu mutants. We also found the same genetic manipulation in hemocytes also suppresses seizures occurring in a different mechanism in a mutant for ethanolamine kinase (easily shocked or eas). Since Drosophila has been used as an evolutionarily well-conserved model organism for innate immunity, our results provide valuable insights into novel strategies to prevent and treat neurological and neuropsychiatric disorders that are associated with aberrant immune function.

86. Clara Stuedemann
Major: Chemistry
Mentor: Dr. Celymar Ortiz de Leon, Leonard MacGillivray (Chemistry)

*Nutraceuticals as Templates for Photoreactions in the Solid State*
Supramolecular chemistry allows chemists to control the organization of multicomponent complexes in the solid state. Cocrystalline materials are solids formed by two or more different molecules interacting via noncovalent interactions (e.g. hydrogen bonds). Cocrystals are an important tool in the modulation of chemical and physical properties of target molecules. Nutraceuticals are food auxiliaries found in nature. In this context, phloroglucinol and resveratrol are two nutraceuticals found in leaves of Eucalyptus and grape skins, respectively. Moreover, the APIs have the potential ability to act as templates in the solid state to align two C=C double bonds (olefins). Upon UV irradiation, the templated olefins can react to yield a four-member ring derivative. Our goal is to study the templating ability of phloroglucinol and resveratrol with three different bis (pyridyl)ethylene (bpe) derivatives: 2,2'-bpe, 3,3'-bpe, and 4,4'-bpe. Using green chemistry methods like mechanochemistry and photochemistry in the solid state, we can reduce waste by use of minimal solvent amounts. We analyzed the products with Powder X-Ray Diffraction (PXRD) and Single Crystal X-Ray Diffraction (SCXRD) to determine if a new product has been obtained.

88. Emma Tews
Major: Nursing
Minors: French, Dance
Mentor: Melinda Myers (Dance), Dr. Catherine Cherwin (Nursing)

Combatting Anxiety-- Adaptive Movement for College of Nursing Students

Activity and movement are consistently shown to reduce stress and anxiety in a variety of populations (Sharma & Madaan, 2006). BSN students need focus, motivation, and resilience to succeed as they prepare to enter a highly demanding and dangerous profession. During the COVID-19 pandemic, students’ habits and ability to maintain activity and movement have been compromised, to some degree, due to the nature of going to school in isolation. BSN students have reported high stress and anxiety (Aslan & Pekince, 2020). The purpose of this work is to describe the impact of an adaptive movement intervention on stress and anxiety in undergraduate college students and BSN students.

Seven non-BSN and 17 BSN students participated in this work over two separate three-week phases, using the first phase as a pilot for the next. Stress was measured using the Perceived Stress Scale, and health beliefs were measured with Healthy Lifestyle Beliefs Scale.

90. Amelia Thoreson
Majors: International Relations, Spanish
Minors: Latino/a/x Studies, Political Science
Mentor: Dr. Brian Lai (Political Science)
How Implementation of rebel preferred agreements in peace agreements influence post war peace?

In civil wars that end in peace agreements, there are often numerous issues and agreements within the broader agreement. Some of these issues and agreements are preferred by the rebels because they address grievances or their ability to survive. These include land reforms and integration into bureaucracies and the government. When implementation of rebel preferred agreements does not occur or is slow, rebel groups will likely challenge the parts of the agreement favored by the government, particularly the cease-fire agreement. Challenging the peace is a way to leverage the government to uphold parts of the agreement that support rebel goals. As a result, violent events should increase and the likelihood of civil war recurrence should rise. We use data on the implementation of different parts of peace agreements to test the violation of ceasefire agreements, the amount of violence, and the likelihood of civil war recurrence. Our results generally support our argument.

92. Chloe Torrence
Majors: Management, Marketing
Mentor: Dr. Jennifer Nahrgang (Management)

Effects of Perceptions of Remote Work and Well-Being

The purpose of this study is to examine the perceptions that supervisors hold on remote work. With an increase in remote work following the COVID-19 pandemic, it is more important than ever to understand how the perceptions of the supervisor regarding remote work can influence their employees. We are specifically interested in how those perceptions influence a supervisor’s leadership behavior, which consequently affects the employees’ well-being, turnover intention, and engagement. This study will include ResearchMatch Volunteers who work remotely or hybrid as the respondents. There will be two surveys, one for the supervisor and one for the employees. The respondents will be asked about their perception of remote work and leadership behaviors. Additionally, the employees will be asked about their turnover intention, well-being and engagement as a result of the supervisor’s leadership behavior.

94. Alexander Tyndall
Major: Accounting
Minor: Psychology
Mentor: Dr. Jaron Wilde (Accounting)

An Analysis on the proposals surrounding the Corporate Tax Rate
My research compares four major tax proposals or legislation that target the corporate tax rate, whether it be through increasing the tax rate, decreasing the tax rate, or adding additional provisions. The four major plans that I cover are: the Tax Cuts and Jobs Act, Joe Biden’s corporate tax proposal, the Build Back Better act and a progressive corporate tax proposal. I give some background and objectives into each proposal, where I discuss the new proposed corporate tax rate, any notable provisions that could affect how much corporations are taxed, and the objectives that a proposal sets forward. I then look further into the plans at hand, by discussing the positive and negative effects each plan might have on various components such as: economic growth, job growth, corporations, and employee bonuses. I also cover any projections that are made regarding the tax plans such as: how much tax revenue can be generated, how many jobs can be created or lost, and how much could the deficit go up. The goal of my research is to summarize the corporate tax rate proposals, and discuss the numerous effects and objectives that each proposal has, and not to advocate for a specific plan.

96. Radha Velamuri  
Major: Biomedical Sciences  
Minor: Certificate in Clinical and Translational Science  
Mentor: Dr. Rainbo Hultman (Molecular Physiology and Biophysics)

Stress Resilience in Amygdala Cellular Subpopulation

Chronic stress yields adverse effects including depressive-like symptoms in susceptible populations. Previously, neurophysiological data defined a network involved in mediating resilient and susceptible states in response to chronic stress arising from projections between the prefrontal cortex (PFC) and the amygdala (AMY), and its chemogenetic activation induced a rescued stress-resilient state both phenotypically and network-wide. Although this complex PFC-AMY circuit has been characterized, it remained unknown which network-specific cell types in the AMY mediate this circuit. AMY cells from the PFC-AMY resilience circuit were analyzed for significant differentially expressed genes (DEGs). The DEGs were compared to a curated database of known amygdalar markers for cell-type identification, yielding two subgroups of in-circuit AMY cells. They were dubbed “large” and “small” cells, and they significantly expressed the excitatory glutamatergic marker Slc17a7 (FC = 3.37, padj = 0.045) and the inhibitory marker Calb2 (FC = 1.28, padj = 0.035), respectively. RNA-Seq data was also analyzed to identify changes in gene expression according to resilience/susceptibility. These results expand understanding of this PFC-AMY circuit and the biology underlying stress resilience. Furthermore, ongoing studies on stress paradigms are being conducted to validate these findings in both males and females as there is a gap in female-focused research.
98. Zachary Vig  
Majors: Physics, Geosciences  
Mentor: Dr. Emily Finzel (Earth and Environmental Sciences)

Using standard major and trace element geochemical measurement techniques, such as LA-ICP-MS and XRF spectrometry, this project aims to quantify the relationship between the carbonate conglomerate clasts of the Cretaceous Beaverhead Group in Southwestern Montana and their source material. After analyzing n = 48 samples, some preliminary unsupervised machine learning algorithms such as Principal Component Analysis and Louvain Clustering were used to inform the correlation between the clasts and their sources. By creating a simple sediment distribution map of the area using these correlations, we hope to confirm or revise the current models for tectonic uplift on both the local and regional scales.

100. Grace Williamson  
Major: Chemical and Biochemical Engineering  
Minor: Chemistry  
Mentor: Drs. Jennifer Fiegel (Chemical and Biochemical Engineering), Nicole Brogden (Pharmaceutical Sciences and Experimental Therapeutics)

Hydrophobic Drug Loading into Thermosensitive Hydrogels  
Impacts Rheological Properties

Severe burn wounds weaken the immune system and require hospitalization. Exposure to common microbes found in hospitals leads to infection. Current treatment includes spreading an antimicrobial ointment on the wound, which can be painful. We have been developing sprayable, antimicrobial, polymer treatments that can be applied to an infected wound as a cold liquid but will transition to a gel state when in contact with the warmer tissue. This thermosensitive hydrogel has the advantages of being applied without pressure, reducing application pain, in addition to providing a cooling effect and the ability to prolong drug release.

Formulation impacts gel viscosity, transition temperature, and stability. Three methods of hydrophobic drug (DS) addition were tested: 1) preparation of bare gel followed by addition of DS the next day, 2) Pluronic F127 and DS combined in water with an overnight resting period, and 3) preparing the bare gel using _ of the water and a drug slurry with the remaining _ water, combined the next day.

Methods were tested for Pluronic percentages of 15-20 w/w%; and DS percentages of 0.5-2.0 w/v%. Gelation is caused by micellization of the polymers, followed by packing when heated. Drugs may enter or be
excluded from the micelles depending on addition time. Preliminary results show minor differences in gelation temperature and more significant differences in storage modulus. Future work will include micelle imaging, sizing, and drug release studies.

102. Evita Woolsey
Major: Speech and Hearing Science, American Sign Language
Mentor: Dr. Bob McMurray (Psychological and Brain Sciences)

Learning to Read Despite Auditory Challenge: Real-time Word Recognition in Cochlear Implant Users

Children who are born profoundly deaf and use cochlear implants (CIs) exhibit reading delays. This could be because pre-lingually deafened CI users are consistently exposed to degraded auditory input, which challenges phonological processing, a critical skill for reading. Traditional assessments of phonological processing do not illuminate the underlying mechanisms behind these difficulties. However, real-time measures, like the Visual World Paradigm (VWP), can assess speech perception more dynamically. In this task, as a spoken word unfolds, fixations to the target word and phonological competitors are measured. Prior VWP studies suggest CI users present delayed lexical access and prolonged activation of phonological competitors, which could indicate a phonological deficit. In the current study, adolescent CI users and NH controls performed a VWP task with both spoken and written words (using a novel variant). CI users showed delayed and less-resolved target activation, as well as delayed and attenuated phonological competition. This was seen in both spoken words and written words. Therefore, degraded listening experiences lead listeners to wait to begin lexical access in both modalities. These results implicate the underlying mechanisms that may contribute to reading delays for adolescents with CIs.

104. Noah Wright
Major: Economics, Political Science
Minor: Psychology
Mentor: Dr. Julia Garlick (Tippie College of Business)

Crime and compensation

How do income, unemployment, and government assistance affect crime? Looking at data covering all 50 states over recent years, I look to identify a relationship between the amount of and ability to receive income and crime rates. Past research has focused on each of these metrics individually, with conflicting results occurring. I am in the process of working with my data to find the effect of these connections.