



**The 15th Annual
Spring
Undergraduate
Research
Festival**

**Wednesday, April 17, 2019
4:30pm-6:30pm**

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

**This event is hosted by the
Iowa Center for Research by
Undergraduates, a unit of the Office of
the Vice President for Research.**

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

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The Spring Undergraduate Research Festival is proud to showcase over **140 visual presentations** given by the University of Iowa's student researchers and creative scholars. Presenters work and study in over **50 different departments** across campus and represent the senior, junior, sophomore, and freshman classes.

Odd numbered posters will present from 4:30-5:25PM
Even numbered posters will present from 5:35-6:30PM
Please note that at 5:25, all of the posters will be switched to the second hour presenters' posters.

We hope that you enjoy talking with these outstanding students and will see you again in for the 8th Annual Fall Undergraduate Research Festival!

Programs with full abstracts are available on the ICRU website: www.uiowa.edu/icru.

Many thanks to the over 100 graduate and professional students and postdocs who have volunteered their time to serve as poster judges for this event.



First Hour Presenters

4:30-5:30PM

(odd numbers only)

1. Melissa Adrian

Majors: Mathematics, Statistics

Mentor: Bruce Ayati (Mathematics)

Understanding the human intestinal microbiome: a mathematical approach

Because the human gut microbiome has the potential to impact overall human health, it has increasingly become a topic of research interest. In order to explore the dynamics of this microbiome, we used a system of ordinary differential equations to mathematically model the biomass of three bacterial populations: *B. thetaiotaomicron*, *M. smithii*, and *E. rectale*, and the relevant nutrients necessary to sustain these populations. This system highlights the interactions and the competition among these species. These three bacteria were specifically chosen due to the system's end product, butyrate, which aids in developing the intestinal barrier. The basis of the mathematical model assumes the gut acts as a chemostat, with bacteria and nutrients flushing out of the gut at a rate proportional to the volume of the chemostat, the rate of volumetric flow, and the biomass of the particular population. We performed sensitivity analysis in order to estimate the model parameters, such as the bacterial growth rates based on the availability of specific nutrients and the rate at which the bacteria and nutrients exit the system.

3. Gabriel Armas

Major: Chemistry

Mentor: Johna Leddy (Chemistry)

Development of Wirelessly Powered and Controlled Electrodes

A limiting factor in electrochemistry is the wired connection between the electrodes and the analytical instruments used. This is due to electrical noise caused by the external power-source traveling through the instrument. Powering the system wirelessly would remove the wired connection between the electrodes and instrument, minimizing the consequent noise. Modern instruments can be accessed through the internet, but these are expensive and need certain infrastructure to be present for its operation. For short to medium distances, one solution can be radio waves, which are capable of sending data and energy directly to and from the electrodes. Electrodes with a wireless power source can be used as a cheap and reliable alternative. The frequencies used for this set up are the same used in everyday remote controls. The system currently under development is a barebones instrument capable of performing basic electrochemical techniques. The next stage of development is to power the device using radio waves and the final stage of development is utilizing the barebones instrument to work with wireless electrodes.

5. Barbara Badovinac

Major: Microbiology

Mentor: Lilliana Radoshevich (Microbiology and Immunology)

Determining the role and localization of protein Rab7A during Listeria infection

ISG15 is a protein that can be induced by the immune system to help defend the host against infection. It is commonly associated with anti-viral activity, however its role during bacterial infection had not been addressed. *Listeria monocytogenes* is a foodborne pathogen that primarily affects immunocompromised individuals and we previously showed that *Listeria* induces the binding of ISG15 to other proteins. We have used a technique called mass spectrometry to identify proteins that bind to ISG15 specifically during *Listeria* infection to understand the function of this pathway in host defense. We identified ISG15 sites in proteins that control a cellular starvation response called autophagy, where the cell "self-eats" to recycle valuable nutrients. This project is focused on one of these targets, the Rab7a protein. To learn more about the effects of ISG15 modification of Rab7a, we are using a wild type Rab7a and a mutant that we have created through genetic engineering that can no longer bind ISG15. ISG15 and Rab7a are mutated in human immune disorders and we hope to understand more about these conditions with this research project.

7. Theresa Baranick; Brianna Cole

Majors: Speech and Hearing Science; Speech and Hearing Science

Mentor: Naomi Rodgers (Communication Sciences and Disorders)

The Effects of Effortful Control and Communication Attitudes on the Accuracy of Self-Reported Stuttering Severity Among Adolescents who Stutter

Effortful control and communication attitudes have been shown to relate to stuttering severity in preschoolers and adults, but no literature exists on this relationship among adolescents who stutter. Further, self-report measures of stuttering severity have been utilized in previous studies, but the accuracy and predictors of self-reported stuttering severity remain unknown. The purpose of this study was to (1) determine the accuracy of self-reported stuttering severity among adolescents who stutter, and (2) examine whether effortful control and communication attitudes predicted accuracy of self-reported stuttering severity. Stuttering severity was calculated for 43 adolescents who stutter using the Stuttering Severity Instrument (SSI-4). The adolescents also self-rated their stuttering severity across eight speaking contexts on a scale from 1 to 9, which were then averaged. Additionally, they completed the Early Adolescent Temperament Questionnaire (EATQ-R) which contains the subscale of effortful control, and the Erickson Scale of Communication Attitudes (S-24). The results showed a moderate positive correlation between trained observer-rated stuttering severity and self-rated stuttering severity. An ANOVA analysis did not show significant group differences in effortful control or communication attitudes. This suggests that there may be other variables not indicated in this study that might better predict the accuracy of self-reporting stuttering severity.

9. Jenah Black

Majors: Psychology, Linguistics

Mentor: Bob McMurray (Psychological and Brain Sciences)

Overlapping vowels aid learning to read: evidence from neural networks

Reading is one of the most important predictors of academic and career success. However, learning to read is incredibly difficult, and many people do not attain proficiency at this basic skill. Reading vowels is particularly challenging due to the quasiregularity of their representation. For example, an 'i' is most commonly pronounced /ɪ/, as in 'bin', but this generalization is often violated, as in 'ski' or 'pint'. Behavioral data from first graders learning to read vowels show that modifying the order in which words are taught changes how well those words are learned, perhaps by reducing the impact of quasiregularity. These results appear to support a theory of learning known as schema based learning. While schema based learning has been shown to hold water in other modalities such as concept learning, the complexities of reading (e.g., quasiregularity) present new challenges. Can schema driven learning account for behavioral data of vowel reading? We constructed a neural network model that will be used to explicitly evaluate claims of schema based learning in reading.

11. Casey Blaylock

Major: Biomedical Engineering

Mentor: Jess Goetz (Orthopedics)

Correcting Flat Feet by Reconstructing the Spring Ligament Using Fiber Tape

A flat foot is caused by weakness in the spring ligament which connects the heel bone to a bone in the middle of the foot. Two cadaveric ankle specimens were used to determine how individual bones located in the middle of the foot rotate in comparison to a normal healthy foot when several different configurations of surgical repairs are used to correct a flatfoot deformity. Each specimen was loaded to simulate standing on one foot and pivoting. Motion capture technology was used to track the movement of five bones when the specimens were loaded. Mechanical testing and motion capture were done for the intact model, a flatfoot that was created by cutting the spring ligament, and six different repair methods using thick bands of suture material called fiber tape to connect different bones at different locations. The rotations of the bones were calculated using a computer program. As the number of bands of fiber tape that connect the heel bone and the bone in the middle of the foot increased, the movement of the bone in the middle of the foot decreased but when the bone in the midfoot was fixed to the leg bone, the movement increased.

13. Alexis Brannan

Major: Human Physiology

Mentors: Leonard MacGillivray (Chemistry), Gonzalo Campillo-Alvarado (Chemistry)

Analysis and Discovery of Solid Forms of the Anticonvulsant Drug Stiripentol (Diacomit®)

Stiripentol is a newly approved FDA drug (2018) for treatment of epilepsy. Because of its oral administration route, it is important to discover new solid forms that could improve physical properties such as thermal stability (as the drug must currently be kept frozen), solubility and bioavailability. There are multiple strategies to design novel solid forms including polymorph screening (i.e., another solid-state arrangement of the same molecule), cocrystallization (i.e., adding another neutral solid molecule to the crystal lattice) or salt formation (i.e., adding a charged molecule that forms a salt by ion pairing with the drug). Our approach involved the cocrystallization technique, attempting to temporarily attach a solid molecule to the drug (conformer) in order to create a stable solid form. This reversible attachment occurred through the weak bonding of hydrogen donors and acceptors identified by the use of the Cambridge Crystallographic software for cocrystal formation. We anticipate the study might be highly beneficial to improve the properties of the commercially available form of Stiripentol.

15. Caroline Brown

Majors: Biochemistry, Spanish

Mentors: Anurag Kakkerla Balaraju (Anatomy and Cell Biology), Fang Lin (Anatomy and Cell Biology)

Planar Cell Polarity in endoderm dependent on Wnt5b-Gpc4 signaling axis

Convergent and extension (C&E) movement is a fundamental morphogenetic mechanism that narrows and extends tissues along an embryonic axis. Planar cell polarity (PCP), a coordinated alignment of cells along an axis across a tissue plane, is essential for efficient C&E movements. Wnt/PCP mutants, knypek or kny (Glypican-4 or Gpc4, a Wnt co-receptor), show wider endoderm indicating a role for Wnt/PCP signaling in endoderm C&E. This research projects aims to identify and understand how Wnt ligands interact with components of PCP signaling pathway to establish PCP in zebrafish endoderm. Confocal imaging of endoderm revealed PCP in endoderm during early segmentation stages. We identified Wnt11 and Wnt5b as ligands required for endoderm morphogenesis during late gastrulation and early segmentation stages respectively. Our findings indicate that Wnt5b potentially interacts with Gpc4 and establishes endodermal PCP during early segmentation stage. Our ongoing studies are aimed at understanding how Wnt5b-Gpc4 interaction establishes endodermal PCP.

17. April Burgess

Majors: Microbiology, English

Mentor: Linda McCarter (Microbiology and Immunology)

Initial Characterization of 5 Proteins in Marine Bacterium Vibrio parahaemolyticus

Bacteria must be able to sense and respond to rapidly changing environments. To do this they synthesize special molecules that affect the cell in many different ways, ultimately leading to a survival advantage. A family of proteins, PilZ, is found in many bacteria including pathogens such as VC and PA. Here we investigate five uncharacterized PilZ proteins to determine how they affect aspects of the cellular lifestyle such as swimming in liquid, moving over surfaces (swarming), or formation of a biofilm in *Vibrio parahaemolyticus*, a marine bacterium and human pathogen. By achieving a better understanding of these proteins, we may better understand how the bacteria adapt to their environment. This knowledge will be essential in developing methods to combat this agriculturally and medically important pathogen.

19. Vanessa Camp

Major: Biomedical Sciences

Mentor: Shujie Yang (Obstetrics and Gynecology)

Enhancing hormonal therapy in endometrial cancer

Malignancies of the uterine endometrium constitute the fourth most frequent cancer type in women with over 63,200 new cases each year. More than 11,300 women die of the disease each year. Endometrial cancer is exquisitely sensitive to the growth promoting effects of estrogen and the growth limiting effects of progesterone. Due to this sensitivity, hormonal therapy using progestins has been a traditional choice for treatment. It is highly effective in the short term; however, responsiveness declines over time due to loss of progesterone receptor (PR) expression. We devised a novel approach to restore sensitivity to progesterone therapy in endometrial cancer patients and coined it, "molecularly enhanced progesterone therapy." This approach involves combining both progesterone and epigenetic modulators to re-sensitize endometrial cancer to progesterone therapy and reverse PR silencing. Our findings have led to the approval of a national clinical trial, and translational studies are underway to confirm the effectiveness of our strategy. These studies have set the stage for creative drug combinations to treat solid tumors traditionally considered to be unresponsive to classic hormonal therapy, and may provide hope to the hundreds of thousands of women battling endometrial cancer.

21. Melissa Carlson

Major: Dance

Mentor: Martine Dunnwald (Anatomy and Cell Biology)

Mafb is not required for formation of palate

Cleft Lip and/or Palate (CL/P) is a facial abnormality found in children that impairs every day functions like eating and talking. Recent studies found a new gene, MAFB, as being associated with CL/P. However, little is known about how MAFB contributes to the formation of the palate. We hypothesized that MAFB is required for the formation of the palate and its removal or alterations in mice will lead to CL/P. To test our hypothesis, we used normal animals or animals with reduced amount of MAFB. Embryos were harvested after 14.5 and 18.5 days following conception, and their heads were evaluated. At e18.5, all the animals exhibited complete palate formation regardless of their amount of MAFB. At e14.5, a few areas of the oral cavity showed abnormal contact, but no statistical significance was found between the groups. This data suggests that MAFB is not required for the formation of the palate.

23. Haoxuan Chen

Major: Speech and Hearing Science

Mentor: Jean Gordon (Communication Sciences and Disorders)

Using verbal fluency to identify Alzheimer's disease

Alzheimer's disease is a degenerative disease of the aging brain associated with dementia. Memory is affected first; later on, language deficits occur. It is the most common dementia and has no cure. Because its onset is gradual, it would be helpful to have a test that reveals the early stages of dementia. Verbal fluency is a widely used measure to assess subjects' cognitive processes following neurological damage. This test often includes two kinds of subtests: one is semantic fluency, which asks participants to produce words in a given category, such as food or animals; another is letter fluency, which requires participants to produce words starting with a certain letter, such as F or S. People with Alzheimer's Disease typically have more difficulty with semantic fluency task than with letter fluency. In the current research, we are investigating whether this task can be used to differentiate Alzheimer's disease from typical aging.

25. Linhai Cheng; Renato Jensen

Majors: Microbiology; Biochemistry

Mentor: Marcello Correia (Internal Medicine)

Skeletal muscle-specific dynamin-related protein 1 deficiency is associated with altered gene expression of proteins that mediate mitochondrial-endoplasmic reticulum contacts and unfolded protein response.

Background: Skeletal muscle of type 2 diabetic patients exhibit mitochondrial dysfunction associated with increased mitochondrial fragmentation. Dynamin-related protein 1 (DRP1) is responsible for mitochondrial membrane constriction during mitochondrial fission whereas mitochondrial-endoplasmic reticulum contacts (MERCs) mark mitochondrial sites of this process. We tested the hypothesis that DRP1 deficiency in skeletal muscle alters mRNA expression of proteins involved in MERCs and unfolded protein response (UPR). **Methods&Results:** We developed a model of inducible DRP1 deficiency in skeletal muscle by crossing mice with DRP1 floxed alleles with mice harboring HAS/ERT2-CRE recombinase. DRP1 mRNA and protein expression were respectively reduced by 60% and 40% in skeletal muscle of homozygous floxed mice expressing CRE [knock out (KO) mice]. The KO mice were resistant to weight and fat mass gain during 60% high fat diet, which was associated with improved tolerance to glucose and increased energy expenditure. We studied MERCs and UPR in normal chow diet-fed KO and wild type (WT) male mice. The mRNA expression of GRP75 was increased while VDAC1 was decreased suggesting altered MERCs in KO mice. The mRNA expression of BIP, CHOP, IRE1 and, notably, FGF21 were increased in KO mice indicating activation of UPR. **Conclusions:** Our study suggests that myokines secreted during UPR, such as FGF21, might help explain the metabolic benefit of DRP1 deficiency in skeletal muscle. Alternatively, altered MERCs can potentially change calcium transients between mitochondria and the endoplasmic reticulum and modify insulin sensitivity in mice deficient of DRP1 in skeletal muscle. Reduction of mitochondrial fragmentation in diabetics can potentially be of therapeutic value.

27. Yung-Chieh Chuang; Rebecca Howard

Majors: Speech and Hearing Science; Speech and Hearing Science

Mentor: Meredith Saletta (Communication Sciences and Disorders)

Semantic Recall Interacts with Verbal Fluency in Adult Word Learning

Important skills in word learning include the ability to: retain and use the name of the new word, remember the features of a new word, and rapidly and accurately recall other words within the same category. To examine how adults best learn words and how word learning interacts with motor learning, we developed a semantic learning paradigm in which participants are exposed to nonwords. Some nonwords were presented with extra semantic information and others with extra motor practice. To quantify word learning, twenty adults recalled the names and features of a series of nonwords, both immediately following the words' introduction and again following a period of consolidation. Participants then performed verbal fluency tasks, in which they named items in a certain semantic category (animals) and items beginning with a certain letter (f, a, and s) as fast as possible. By comparing (1) the number of words retrieved along with the depth and breadth of clusters (groups of words that share features) produced in fluency tasks and (2) the number of correct features of nonwords elicited in immediate and delayed recall tasks, we can begin to design clinical interventions for word learning and determine the relationship between motor and language learning.

29. Mackenzie Cross

Majors: Anthropology, Interdisciplinary Studies

Throw Your Hands Up: Specialized Forms of Moving in Lemurs Influence Behavior

Lemurs are a diverse group of primates which display an impressive range of adaptations. Many different species of lemur have specialized forms of moving such as the Sifaka (*Propithecus coquereli*) who leap in an upright posture from tree to tree in a style known as vertical clinging and leaping. Other lemurs, such as the Ring-tailed lemur (*Lemur catta*), are primarily quadrupedal. These different styles of movement confer different costs to the species. For instance, the Sifakas' vertical clinging and leaping is more intensive than the Ring-tailed lemurs' quadrupedalism. To better understand how movement influences behavior, I gathered data on the frequency and type of movement for six species of lemurs, which spanned forty-one individuals. This work contributes to growing understanding of primate movement and behavior.

31. Christine Czarnecki

Major: Chemical and Biochemical Engineering

Mentor: Jennifer Fiegel (Chemical and Biochemical Engineering)

Method development for antibiotic effectiveness on Pseudomonas aeruginosa bacteria via aerosol technology and inhibition studies

Due to the presence of bacterial biofilms, bacterial infections in the lungs are often difficult to eradicate. This reduces the effectiveness of traditionally administered antibiotics. Our lab is developing combination therapies to increase the susceptibility of bacteria to antibiotics. The objective of this study is to develop a method for impaction of dry powder antibiotic aerosols on *Pseudomonas aeruginosa* bacteria. The antibiotic powders used in this study were generated using a spray dryer and contain a nutrient dispersion compound to increase bacterial exposure to the drug. The developed method involves viable impaction and image analysis using the ImageJ processing program and Copley software.

33. Madeline Demro

Major: Speech and Hearing Science

Mentor: Patricia Zebrowski (Communication Sciences and Disorders)

Portraits of Change: Challenging Perceptions about Diverse Learners and Education through First-Hand Interactions

In an age bursting with multicultural diversity, self-reflection of perceptions and biases can help foster compassion and develop drive for advocacy. Experiencing transformative learning first hand led to the desire for deeper

understanding of others' experiences. Specifically, for this study, perceptions of multicultural populations in a rural community were expressed through reflective writings as part of a university service-learning course. This study focuses on the process students undergo when transforming their knowledge and perceptions by exploring different themes that arise and how they change due to having first-hand interactions that explicitly complicate their pre-established perceptions and knowledge specifically pertaining to learning and education. To examine how students may transform their knowledge and perceptions throughout a learning experience, this study employed the method of narrative portraiture combined with a general thematic analysis. The results showed two major portraits of learning. Portrait one demonstrated a major shift in the thinking process from the individual to the collective with initial perceptions very surface and the realization that those perceptions were insufficient. Portrait two took a more critical direction that included changing one's actions and referencing prior experiences with problematizing privilege and diversity. These changes in perception were not always positive, but the desire for change and civic responsibility was.

35. Olivia Dieschbourg

Major: Management

Mentor: Beth Livingston (Management and Organizations)

Employer Perception of Candidates Before and After Negotiation

This research examines how the act of negotiation alters an employer's view of a candidate. Negotiation and gender, as well as the economic consequences of negotiation, have been a widely studied topic. My research expands the topic of negotiation further to delve into the subjective and non-economic results of various methods of negotiation. We used a survey to discover how subjects viewed male and female candidates after being presented with the job description and resume, as well as after the candidate has responded in one of four emails. Survey takers see either a male or female's name and pronouns on an otherwise identical resume. After rating the candidate, survey takers then see an email communication from the candidate in which they: 1) accept the offer 2) ask for a higher salary without offering a reason 3) ask for a higher salary by citing market research or 4) ask for a higher salary to match their current salary.

37. Megan D'mello

Major: Human Physiology

Mentors: Leonard MacGillivray (Chemistry), Gonzalo Campillo-Alvarado (Chemistry)

Recognition and Separation of Petrochemicals Through a Boron Based Molecular Sponge

Petrochemicals are an important class of molecules utilized in everyday life in products such as plastics, detergents, clothing, and pharmaceuticals. The high demand for pure petrochemicals require extensive work from the industry to separate the impurities found in crude oil. Current separation methods are

challenging, both financially and energy expensive, accounting for 10-15% of the world's energy consumption. Indeed, ongoing efforts involve the development of more energy-efficient and inexpensive methods to supply the increasing demand of petrochemical materials. In this project, we have developed a boron-based molecule that is able to recognize common impurities present in the petrochemical materials. Our approach involves the use of supramolecular interactions such as hydrogen bonds to trap impurities and molecules of interest into a crystal made from the boron host. We anticipate that our method is a cost-effective and environmentally friendly approach to recognize and capture impurities in the petrochemical industry.

39. Hannah Dunn; Lexi Kolterman

Majors: Speech and Hearing Science; Speech and Hearing Science
Mentor: Shawn Goodman (Communication Sciences and Disorders)

Changes in Auditory Reflex Effect with Changes in Sound Input

Most mammals have a reflex in the brainstem that helps the auditory system process sound. This reflex is called the medial olivocochlear efferent reflex (MOCR), and it is believed to improve hearing in background noise (such as a speaker in a crowd of people). Past research has shown that the reflex acts differently when it is presented with different input levels (soft vs. loud stimuli). We hypothesized that the apparent differences in MOCR's behavior actually correspond to an equivalent constant reduction of the stimulus input. To measure the reflex at different levels, we used otoacoustic emissions, which are soft sounds emitted from the inner ear that can be measured with a small microphone placed in the ear canal. In our study, we presented acoustic clicks at varying loudness levels with and without MOCR activation. The data were consistent with our hypothesis of an equivalent constant reduction in input level.

41. Abby Fronk

Major: Biology
Mentor: Shujie Yang (Obstetrics and Gynecology)

A unique tool to visualize PR expression in endometrial cancer cells

Endometrial cancer is the most malignant gynecologic cancer with incidence and death rates increasing due to lack of sufficient treatments. Progesterone therapy has a favorable clinical outcome especially in tumors with high progesterone receptor (PR). However, PR is lost in advanced endometrial cancer and doctors have sought to increase PR for decades. We devised a way to visually monitor PR expression through a reporter gene, mCherry. This reporter gene allows the cells to glow red in the presence of PR, and can be used for many useful applications. We treated cells with the successfully inserted reporter gene with an FDA-approved drug library. These drugs are approved for use in the clinic, and we were able to identify drugs that successfully increased PR expression. Another application was the use of a gene knockout library and allowed us to analyze the effect on PR and identify new PR repressors. Our discovered drugs and repressors were then verified through cellular studies. Additional screening and testing is anticipated in hopes of identifying more repressors and molecular inducers. This established reporter gene tool can be applied to other target genes and cancers as well, and facilitate many new and revolutionizing discoveries.

43. Carly Garcia

Major: Speech and Hearing Science

Mentor: Jerald Moon (Communication Sciences and Disorders)

Assessment of Service Utilization of Patients Managed by a Cleft Palate Team to Analyze Impact from Three Perspectives

Cleft-lip and palate (CLP) is a disorder that requires medical care from many different professionals. Therefore, it makes sense to coordinate care between these professionals to best serve the child and family involved. However, researchers struggle to find proof that team-based care is best. In this study the usefulness of team care was evaluated through three perspectives: the impact on the hospital as a whole, impact on the professionals that treat patients with CLP, and the impact on patients and families themselves.

These perspectives were analyzed using medical record data from 777 children with CLP. Insurance billing data, most visited specialties, number of specialties scheduled per visit, and distance of travel were looked at from 2013-2017. Little change occurred in insurance payer types across years. Changes in hospital and protocol seem to have had the greatest effect on clinicians. Distance of travel followed similar patterns for 2013, and 2014. This changed in later years with increased distance and number of specialties scheduled per visit. As more specialties are scheduled within one visit, the effects benefit patients and their families, and the clinicians treating them. With time, these effects will likely extend positively into the hospital system as increased revenue generation.

45. Stacy Garrard

Major: Speech and Hearing Science

Mentor: Carolyn Brown (Communication Sciences and Disorders)

Hidden Hearing Loss

Hidden Hearing Loss (HHL) is a condition where individuals may have normal hearing but difficulty understanding speech in background noise. To date, a specific diagnostic criterion is not established. In 2016, Liberman and colleagues published a study comparing neural responses from musicians considered "at risk" for HHL with a control group. Individuals "at risk" were found having more difficulty understanding speech in noise than control individuals. Liberman et al (2016) described a technique for measuring responses of the auditory nerve and found abnormal measures for the "at risk" group, concluding that HHL may be resulting from damage to the auditory nerve caused by extended, low level noise exposure. In this study, we attempted to these replicate findings. We recruited 11 normal hearing college students who reported listening to music regularly using headphones. We tested hearing, measured output levels from headphones and distributed a survey regarding noise exposure history. We identified risk factors commonly associated with hearing loss and found a significant correlation between number of risk factors per subject and performance on a speech in noise task. We then used the same methods Liberman used to assess neural responses to brief sounds. Overall, we were unable to replicate Liberman's findings.

47. Joshua Gingerich

Major: Mathematics

Mentor: Isabel Darcy (Mathematics)

Graph Coloring and Advertisement Groups

This project utilizes graph theory methods to determine groups of products that would benefit from being advertised together. The likelihood that a consumer would respond well to a specific advertisement could be better predicted by examining the consumption habits of other consumers. This can be modeled by using a graph that can represent both products and consumers' consumption behavior. Through the technique of graph coloring, the graph can be divided into several groups of different colors based on consumers' behavior. Each group of the same color would correspond to a group of products that would likely benefit from being advertised together. This project analyzes the amount of time required to produce a coloring of such graphs.

49. Nicole Gorny

Majors: Psychology, Biochemistry

Mentor: Susan Lutgendorf (Psychological and Brain Sciences)

The Effect of Chemotherapy and Exercise on Cardiometabolic Risk Factors in Ovarian Cancer Patients

Due to late detection and the likelihood of advanced stage progression, ovarian cancer is one of the most deadly diagnoses for women, with a 5-year survival rate less than 50%. Thus, protective measures ranging from comorbidities to lifestyle choices are relevant to prevention and chemotherapy effectiveness. Cardiometabolic dysregulation- a combination of risk factors including hypertension, lipid or glucose imbalance (diabetes, high cholesterol, etc.), and obesity- is of particular interest and may be influenced over the course of treatment by physical activity. This study examined whether metabolic regulation significantly changed after chemotherapy compared to pre-surgery levels, and if so, in which direction. We expected physical activity prior to cancer diagnosis to predict levels of metabolic dysregulation at 1-year. Clinical variables defining metabolic dysregulation and self-report physical activity data were collected during baseline and 1-year follow up visits. Analyses suggest that cardiometabolic regulation does improve from baseline to 1-year follow up, and metabolic dysregulation at 1-year is predicted by baseline levels. However, pre-diagnosis physical activity levels do not appear to predict cardiometabolic dysregulation at either time point. The results of this study support the hypothesis that metabolic dysregulation does change over the course of treatment, but exercise does not appear to predict this change.

51. Jesse Gray

Major: Human Physiology

Mentors: Ryan LaLumiere (Psychological and Brain Sciences), Victoria Muller Ewald (Psychological and Brain Sciences)

Neurons in the infralimbic cortex adapt to promote cocaine abstinence

A central issue in cocaine addiction is that addicted individuals are vulnerable to relapse despite extended periods of drug abstinence, inspiring researchers to investigate the neural circuitry underlying this occurrence. Previous research using a rat model of addiction revealed that the infralimbic cortex (IL) is crucial in extinction learning and the suppression of cocaine-seeking behavior. However, most investigations involve manipulations of the IL—little research has directly recorded the activity of this brain region. This study used *in vivo* electrophysiology to record neurons within the IL as rats self-administered cocaine and experienced withdrawal from cocaine. This study demonstrated that there are subgroups of neurons within the IL that respond to lever pressing, the availability-onset cue, and the decision to press the lever. Additionally, firing patterns in the IL change as animals learn to decrease their cocaine seeking. This study illustrates the involvement of the infralimbic cortex in modulating cocaine-seeking behavior.

53. Yuwei Guo

Major: Biochemistry

Mentor: Huojun Cao (Endodontics)

Tooth Initiation

Our experiment focuses on figuring out what initiates the development of teeth, more specifically what different transcription factors are present.

55. Yu Hao

Major: Mathematics, Business Analytics

Mentor: Isabel Darcy (Mathematics)

Identifying the components of a graph

Graph theory is an important mathematical method that used in many areas like computer science, physics, social science and so on. In graph theory, we use graphs to represent the connections between objects and relationships between people to simplify those complicate problems.

Scenario: In a huge party with thousands of people, suppose a person can only know a stranger by an intermediary (except the party holder) who knows both of them. The problem I want to solve is to get how many people a person finally can know and how many groups will be there.

57. Grace Holbrook

Majors: English, International Relations

Mentor: Barbara Eckstein (English)

The Peoples' Weather Map

The Peoples' Weather Map is an interactive digital map that encourages Iowans to engage with their local severe weather history. We are focused on depicting the human relationship to weather and climate. Each of the 99 counties has at least two stories covering events that range from the 1800s to the present day. Not only does this format encourage individuals to explore their histories, but they have the opportunity to contextualize the severe weather events with scientific climate change data available on the website. Additionally, readers are encouraged to engage in the histories of other counties. We focus on six hazards: droughts, floods, insects, heat, blizzards, and tornadoes. Each story highlights at least one of these events and identifies how each community responds; no one county is the same. The unique identities of each county allow us to write culturally and socially distinct narratives that prompt the individuals reading them to reconsider their relationship to weather. Finally, our work incorporates the stories of minority populations, such as Native American or Latinx, to create a complete picture of Iowa's population.

59. Sydney Jellison

Major: Human Physiology

Mentor: Gen Shinozaki (Psychiatry)

Genome-wide DNA methylation investigation of glucocorticoid exposure within buccal samples

Glucocorticoids have a major role with regulating stress response, and imbalances of glucocorticoids have shown to be involved in stress-related disorders. Stressful life events such as traumatic experience can influence the epigenetics status on DNA, and glucocorticoids are hypothesized to be mediating such epigenetic processes, including DNA methylation (DNAm) change. To better understand the effect of glucocorticoid exposure on genome-wide DNAm in humans, we collected buccal (cheek swab) samples from dental patients before and after tooth extraction treated with a high-dose of dexamethasone. Genome-wide DNAm levels were compared between these samples. Epigenetic changes of DNAm were studied using the Infinium HumanMethylationEPIC array and found five CpGs had genome-wide significant DNA methylation changes greater than 10%. When those signals were compared to previous data on changes in gene expression in human blood after exposure to dexamethasone, a significant amount of genes with false-discovery-rate-adjusted significant CpGs were also expressed differently. Our data showed that high-doses glucocorticoid given in dental procedures identified several CpG sites where DNAm changed significantly in buccal samples, which is consistent with previous findings of expression change after glucocorticoid exposure. Investigating glucocorticoids effect on DNAm further with an increased proportion of the genome with larger sample size is needed.

61. Khaled Kayali

Major: Biomedical Engineering

Mentor: Hanna Stevens (Psychiatry)

Effects of Cypermethrin on the Morphology and Number of Microglia in the Embryonic Brain

Alpha-cypermethrin is a type II pyrethroid that is found in commonly used household insecticides and is recommended for use by pregnant women to prevent mosquito-borne disease. Prenatal exposure to alpha-cypermethrin is a risk factor for altered neurodevelopment in children, however the mechanisms through which this occurs are not understood. To address this, we examined how prenatal exposure to alpha-cypermethrin affects microglia in the embryonic brain, as microglia play critical roles in the processes of neurogenesis, synaptic maturation, and brain wiring during development. In addition, we assessed placental inflammation and oxidative stress as mechanisms by which cypermethrin alters microglial development. Pregnant CD1 mice were administered alpha-cypermethrin or vehicle via oral gavage (10 mg/kg) daily from embryonic day 11 to 14. Embryonic day 14.5 brains were stained with Anti-Iba1 to identify microglia morphology by fluorescence microscopy. Gene expression by qPCR and oxidative stress by biochemical assays were measured in the placenta. Results from this study demonstrate that alpha-cypermethrin increased the percentage of multi-vacuolated microglia in the embryonic brain. Consistent with these changes, cypermethrin upregulated placental inflammation and oxidative stress response. Further research will involve assessment of microglia at later developmental stages and placental immune cells (i.e. macrophages) that may contribute to toxicity.

63. Elias Kovoov

Major: Human Physiology

Mentor: Martine Dunnwald (Anatomy and Cell Biology)

Function of Interferon Regulatory Factor 6 (IRF6) in Keratinocyte Polarity

Interferon Regulatory Factor 6 (IRF6) is a gene that is expressed in some skin cells. IRF6 is required for keratinocyte (a type of skin cell) cell migration. When a cell migrates, it has a leading edge and a lagging tail. The Golgi apparatus and MTOC are two structures that are typically found around the nucleus in a cell that is not migrating but reorient toward the leading edge of a migrating cell. We hypothesized that the lack of directed migration in IRF6 deficient keratinocytes is due to a lack of cellular polarity. To test our hypothesis, the orientation of the Golgi and MTOC were examined using fluorescent markers in migrating cells at different time points. If IRF6 impacts the Golgi and MTOC, we expect them to orient in front of the nucleus only in the leading edge of migrating wildtype cells. The Golgi and MTOC were localized around the nucleus for both wildtype and IRF6 deficient migrating cells. The data was inconclusive as the Golgi and MTOC did not localize in the leading edge of the cell which was the expectation going into the study for wildtype migrating cells based on previous published studies.

65. Kylie Krier

Major: Interdisciplinary Sciences

Mentor: Madeline Shea (Biochemistry)

Calmodulin

Calcineurin (CaN), a calcium-activated phosphatase, has been tied to heart development, immune system regulation, and Alzheimer's Disease. Congenital heart defects are the most common birth defects in the US. CaN inhibitors are used as immunosuppressant drugs to mitigate host-graft rejection during transplants. Dysregulated Ca²⁺ signals, which activate calcineurin, are thought to play a significant role. Exploring the mechanism of CaN regulation and activation has diverse and profound clinical implications and allows us to develop better drugs. We will study CaN activity by using methods of biophysical chemistry to understand how it is able to take phosphate groups off other proteins when regulated by calmodulin, a calcium-binding sensor protein.

67. Kathryn Kuennen

Majors: Anthropology, Ancient Civilizations

Mentor: James Enloe (Anthropology)

What's on the Menu? Analysis of the Faunal Assemblage from Woodpecker Cave

Woodpecker Cave is a Middle to Late Woodland rock shelter site located near the Coralville Reservoir, and was the location of the University of Iowa's field school from 2012-2018. Identifying the animal remains from an archaeological site can help us understand and recreate the environment that the site's inhabitants lived in, as well as the animals they hunted to survive. From this past field season, summer 2018, over 5200 pieces of bone were recovered from the site. These faunal remains were then sorted and identified by element and assigned to genus and species. Care was also given to identify evidence of butchery, including cut marks and bone fractures. The results demonstrate that the faunal remains recovered from 2018 were primarily white-tailed deer (*Odocoileus virginianus*). Many other species were also identified including bison, elk, dog, raccoon, opossum, rabbit and squirrel.

69. Jacob Lam

Major: Biochemistry

Mentor: Antentor Hinton (Internal Medicine)

The Role of Insulin in Cristae Morphology

Mitochondria play a large role in respiration and energy production. Within these organelles, there are folds in the inner membrane that are referred to as cristae. These cristae provide a surface area for chemical reactions to occur on and are therefore essential to mitochondrial function. Previous research has shown that proteins such as Optic Atrophy Protein-1 (OPA1), CHCHD6, Mitofilin, CHCD3, and Sam50 are all vital for cristae structure. Thus, when these

proteins are knocked out (reducing the amount of protein produced) using a method called CRISPR, cristae maintenance is disrupted. Insulin stimulation has been shown to increase mitochondrial fusion and cristae density through an OPA1 dependent mechanism. Therefore, we hypothesize that insulin stimulation may be able to increase other cristae proteins. To test our hypothesis, we knocked out each of these proteins in mice and human muscle cells with CRISPR. We then tested protein levels with and without insulin stimulation to quantify whether insulin restores protein levels. Transmission electron microscopy was used to observe the effect of knocking out cristae proteins with and without insulin stimulation. Together we found that insulin stimulation changes cristae morphology.

71. Michael Leaman

Major: Human Physiology

Mentor: Kathleen Markan (Pharmacology)

Fat Cell Development as a Therapeutic Avenue for Obesity

Beige fat cells express high levels of a protein known as uncoupling protein 1 (UCP1) which assists in the dissipation of energy as heat and thus increasing energy expenditure. Therefore, it has been thought that increasing beige fat cell expression could be used to counter the development of obesity. T-box transcription factor-1 (TBX1) has been identified as a marker of beige adipocytes in rodents and humans. Although TBX1 function is necessary for development of certain cell types, nothing is known regarding its function in fat cells. To test if TBX1 is sufficient and necessary to convert mature fat cells into beige UCP1 positive fat cells and potentially prevent the development of obesity, we generated two novel mouse models. One modeled for over-expression of TBX1 (TBX1 AdipoTG) and the other modeled adipocyte specific deletion of TBX1 (TBX1 AdipoKO). These data suggest that although adipocyte TBX1 regulates UCP1 expression in subcutaneous fat tissue, its expression in mature white fat cells is not sufficient to drive beiging and prevent the development of diet induced obesity. Rather, adipocyte TBX1 functions to regulate adipocyte size and growth and may play a necessary role in the regulation of glucose homeostasis and insulin sensitivity.

73. Xinyu Mai; Shuo Song

Majors: Physics, Astronomy; Psychology, Philosophy, Physics, Astronomy

Mentor: Robert Mutel (Physics and Astronomy)

An Updated Model for Circumstellar Planets Orbiting the sDB Binary NY Virginis

We studied two stars orbiting each other with possible orbiting planets. We found that the time it takes the stars to complete one full orbit (period) has very small changes over several years. One cause of these changes could be the gravitational perturbation of planets orbiting around the two stars. To test this, we observed a short-period (3 hour) binary system eighteen times over the past year using the Iowa Robotic telescope in Arizona. We combined these

data with previously published data to infer the existence of planets. Our results show that there are two planets orbiting around the binary star system in elliptical orbits. The two planets have masses of 2.7 and 5.5 times of the mass of Jupiter. Their distances are about the distances between the Sun and Jupiter and Saturn respectively. However, the properties of the planets are not well constrained; we need more observations to better determine their exact properties.

75. Molly Matkovich

Major: Mathematics

Mentor: Gordon Buchanan (Neurology)

Role of serotonin neurons in seizure frequency and severity across sleep and wake states

Epilepsy is a neurological disorder characterized by recurring seizures. Seizures often occur when patients are awake or in non-rapid eye movement (NREM) sleep. However, almost no seizures occur during rapid eye movement (REM) sleep. The reasons for this discrepancy are not well-understood. The neurotransmitter serotonin (5-HT), which also modulates sleep wake state, regulates seizures. Some 5-HT neurons change their firing patterns depending on sleep state. Therefore, we hypothesized that eliminating these neurons would alter the relationship between sleep state and seizure activity. To test this, a mix of male and female mice were used. Of these animals, some were genetically altered to not have 5-HT neurons (knockout) while others did not have this alteration (wild type). All were made to have recurrent seizures using the drug pilocarpine. Then they were outfitted with EEG/EMG recording devices and observed for 7-10 days. Sleep state and seizure occurrence were analyzed. Preliminary analyses indicate that 5-HT deficiency did not change the number of seizures experienced by the mice, but more seizures did originate during REM sleep. Further studies may investigate the source of 5-HT and the site of action wherein 5-HT regulation processes occur.

77. DorisAnn McGinnis

Major: Psychology

Mentor: Natalie Denburg (Neurology)

The Impact of Executive Functioning on Iowa Gambling Task Performance Among Healthy Older Adults

The Iowa Gambling Task (IGT) is a widely used cognitive instrument that predominantly measures executive functioning. In spite of its popularity, the IGT has not been without its critics. Chiefly, it has been criticized for being complex and therefore not decomposable into its component parts. Additionally, there are other critics who have questioned the construct validity of the measure. In this study, we aim to investigate what specific components of executive functioning play a role in IGT performance. We utilized a well-validated battery of executive functioning tasks, entitled the Delis-Kaplan

Executive Functioning System (D-KEFS), as well as the aforementioned IGT. Both were administered to a healthy sample of community-dwelling older adults as part of a larger study. When examining associations between D-KEFS subtests and the IGT, we observed significant associations with abilities such as set-shifting, fluency, inhibition, problem solving, and planning, with planning accounting for the greatest amount of variance in IGT performance. Implications of the current research will be discussed.

79. Andrew McKeen

Major: Human Physiology

Mentor: Melissa Bates (Health and Human Physiology)

SAMSN1 Affects the Immune Response: Involvement for Blood Cancer

The SAM domain, SH3 domain and nuclear localization signals 1 or SAMSN1 protein acts as part of the immune system in the body and helps control antibody levels when functioning properly. This protein is thought to play a role in the development of Multiple Myeloma, however, its significance in the development is unknown. An experiment was previously done studying a strain of mice called Kalwrij. The Kalwrij mouse serves as a model of the human multiple myeloma patient, because it has a deletion of the Samsn1 gene, as well as other mutations resulting in a high likelihood of developing multiple myeloma. In the experiment, the immune system of the Kalwrij mouse was tested in comparison to a B6 mouse strain which is a healthy, normal mouse through a series of immunizations and collecting data about antibody levels. The results were not as expected leading to further experiments testing different mice strains such as the F2 mouse strain which is a mix of the Kalwrij mouse and the MYC mouse as well as a HACS mouse strain to determine the affect the SAMSN1 gene truly plays in the development of mutliple myeloma.

81. Jade Miller

Major: Biochemistry

Mentor: Maria Spies (Biochemistry)

Protein binding with DNA quadruplexes

The double-helix model of DNA is widely popularized and accepted, but not all DNA exists in this form. This project involves DNA sequences rich in guanines that can form what's called a G4 quadruplex, a structure of DNA that loops in on itself due to bonds between guanines. The focus of this project is the binding of three proteins- REV1, FANCI, and BG4- with these sequences and with each other, and how these interactions can influence the expression of these DNA sequences.

83. Caitlin Nelson

Major: Speech and Hearing Science

Mentor: Elizabeth Walker (Communication Sciences and Disorders)

Question Asking During Conversational Interactions in School-Age Children

Any degree of hearing loss puts a child at risk for language delays; many children with a varying amount of loss demonstrate proficiency in language when comparing scores on norm-referenced assessments. Researchers suggest that standardized tests, used to determine special education eligibility, may not be sensitive enough to detect language delays in this population. Children with hearing loss are at an increased risk for reduced access to auditory input and conversational interactions which results in difficulties with social language. Language sample analysis is a clinically- and theoretically-relevant area to examine for this group. There is a need for information regarding how children develop the ability to ask questions and their pragmatic skills. The current project, Question Asking During Conversational Interactions in School-Age Children, investigates three research questions: 1) Does the quantity of the questions differ between groups? 2) Are grammar abilities associated with the social functions of children with hearing loss? 3) What are the social functions of questions produced by children with hearing loss and children with normal hearing and how does it differ? Our long-term goal is to develop evidence-based strategies that will aid the identification of children with hearing loss at risk for difficulties in language acquisition.

85. Aleisha Norton

Majors: Biology, Psychology

Mentor: Susan Lutgendorf (Psychological and Brain Sciences)

Assessing the Impact of the "Above and Beyond Cancer" Program on Cancer Survivors

This study examined the effects of a unique survivorship program entitled Above and Beyond Cancer on adult cancer survivors' post-cancer well-being and personal growth. Above and Beyond Cancer is a non-profit organization in Des Moines, Iowa the mission of which is to improve lives of cancer survivors by taking them on challenging journeys worldwide. Participants (N=21) were adult cancer survivors who took part in one of three Above and Beyond Cancer journeys. Analyses examined if there was a significant change between pre-trip and post-trip on measures of quality of life, well-being, mood, spirituality, and physical activity. Significant improvements were seen in environmental mastery, a component of well-being, as well as decreases in anxiety and cancer-related body concerns. No significant differences were observed in spirituality and physical activity. Implications of these results include potential benefit of interventions targeting well-being in cancer survivors. Future studies can expand on this study by implementing a randomized control trial with a larger sample size.

87. Claire O'Connell

Major: Biomedical Engineering

Mentor: Terry Braun (Biomedical Engineering)

Implementing Structure Visualization for Better Genetic Variant Analysis

Being able to visualize proteins and genetic variants within the protein provides a valuable tool for the study of genetic diseases. This is the case with genetic related deafness. Although it is preferred to use experimental studies to make specific diagnoses, there are times when experimental studies are not feasible. In this case, the application of algorithms along with high quality molecular structures can be used to augment a patient's diagnosis. This was applied to the Deafness Variation Database (DVD), a database containing hundreds of thousands of genetic variants related to hearing loss curated by the Molecular Otolaryngology and Renal Research Laboratories (MORL). An interactive three-dimensional molecular visualization tool called NGL was integrated with the website to allow for spatial analysis of the genetic variants within the database. This allows for clinicians and researchers working with deafness to gain a deeper understanding of genetic variants and their relationship to disease.

89. Mara O'Connor

Major: Human Physiology

Mentors: Hanna Stevens (Psychiatry), Jonathon Dowell (Psychiatry)

The behavioral and neuronal impacts from counteracting autism-associated gene mutations

Introduction: Autism spectrum disorder (ASD) is a neurodevelopmental disorder with genetic risk factors, one of which is a mutation in the branched chain ketoacid dehydrogenase kinase (BCKDK) gene, disrupting metabolism of branched chain amino acids (BCAA), some of the building blocks for proteins. Previous data showed that BCKDK knockout mice had more active neurons in a region of their brain responsible for motor behavior than wild type mice. However, the impact of replenishing BCAAs directly into this region of the brain has not been studied. Methods: Mice with the BCKDK gene removed were tested for motor learning performance. Brains of mice with BCAA or saline infused into the motor behavior region were examined for active neuron populations. Grooming behavior of mice that received infusions was also assessed. Results: BCKDK deficient mice had better learning than normal mice. Preliminary data shows some differences in active neuron populations and grooming behavior in normal and mutant mice replenished with BCAAs directly to the brain. Conclusion: These results give us a better understanding of specific brain problems from this BCKDK mutation which can cause ASD in people. These advancements may allow for better treatments to be developed for the problems of ASD.

91. Erik Ovrom

Major: Interdepartmental Studies

Mentors: Tori Forbes (Chemistry), Mohammad Shohel (Chemistry)

Isolation of Gallium Substituted Polyaluminum Clusters in Aqueous Solution

Aluminum is one of the most abundant elements on the earth's surface. Depending on conditions such as pH, temperature, and chemical environment, aluminum ions in water can bond together through oxygen bridges to form polyaluminum clusters with different sizes and configurations. In the geoenvironmental system, different metals can substitute the aluminum to form heterometallic clusters. This is a mechanism of transporting contaminants in aqueous solution. The polyaluminum clusters and their heteroatom versions are not only relevant to geochemical processes, they also have numerous commercial applications, e.g. water treatment, antiperspirant, pillaring agents, and modeling of mineral surfaces. Understanding the formation and chemistry of these clusters is important with respect to industry and the environment. But, a lack of knowledge complicates their isolation and identification in aqueous solution, so there are very few reports on this topic in the relevant literature. In the present study, we synthesized several novel Ga-substituted polyaluminum clusters—with different sizes and configurations—by titrating a solution containing AlCl_3 and GaCl_3 with NaOH at 90 degrees Celsius, followed by hydrothermal aging. A variety of different crystallizing agents were used to isolate the clusters, which were then characterized using single crystal X-ray diffraction.

93. Anthony Pamatmat

Major: Biomedical Science

Mentors: Ronald Weigel (Surgery), Anna Beck (Surgery)

CD44 Expression in Human Colorectal Cancer Cells After Topotecan Treatment

Cancer stem cells are a subpopulation of cancer cells that have the ability to create new tumor cells and metastasis. Studies have shown that cancer stem cells are resistant to chemotherapy. Sumoylation is a protein modification pathway that facilitates cancer stem cells. Topotecan, a chemotherapy drug currently used to treat ovarian cancer, has been shown to inhibit sumoylation. This study investigates the effect of Topotecan on colorectal cancer stem cells by measuring CD44 levels, a common cancer stem cell marker. We first treated HCT116, a colon cancer cell line, with topotecan and measured CD44 expression using a western blot, which showed a decrease in CD44. We then injected mice with colon cancer cells from patients, allowed the tumors to grow out to 400 mm^3 , treated with topotecan for three weeks, harvested the tumor, and analyzed CD44 expression using flow cytometry. Our results indicate decreased levels of CD44 expression after topotecan treatment in one of three mouse models, indicating topotecan may be used to target cancer stem cells in only select patients.

95. Joshua Parbs

Major: Biochemistry

Mentor: Maria Spies (Biochemistry)

The Molecular Mechanisms of XPD as it Relates to Human Genetic Disease

Xeroderma Pigmentosum Complementation Group D (XPD) is a regulatory protein that serves as a genomic caretaker. These proteins play a crucial role when it comes to the accurate replication, recombination, and repair of DNA. They ensure that each step of these processes is carried out correctly, and serve to regulate these fundamental procedures when they go awry. However, these molecules aren't perfect, and buildup of damaged DNA can lead to genetic instability as well as various diseases. XPD is analyzed at the molecular level in order to better understand its specific structure and function. This allows for the molecular mechanisms of this protein to be identified and investigated. Investigation of these mechanisms may be crucial in determining the process by which these proteins identify and repair damaged DNA. Developing an understanding of XPD at the molecular level may also provide insights as to how other genomic caretakers function. These insights could show how these proteins relate to various genetic diseases, which would have numerous applications regarding the way they are treated and combated in the medical world.

97. Pooja Patel

Major: Biomedical Sciences

Mentor: Lori Adams (Biology, Latham Science Engagement Initiative)

Showcasing Pathogenic Viruses through the use of Art

This project entails creating pictorial representations of viruses that cause human disease and increasing the awareness of these pathogens/their mechanisms of action through the use of this art. The viruses that are displayed as a part of the project include: Human Immunodeficiency Virus (HIV), Ebola virus, Influenza, Zika virus, Hantavirus, Dengue virus, Bacteriophage that causes Cholera, Rabies virus, Hepatitis A/B/C virus, and Human Papilloma Virus (HPV). These viruses all impact humans around the world, therefore they are easy to relate to. Understanding more about these pathogens will increase awareness of their mechanisms of action and the diseases they cause. Each of the virus images includes a QR code that links to the project's Stem-O-Sphere blog. This blog has more information regarding the virus, the parts of the virus, and its implications on human health/how it causes disease. Images of the viruses are also portrayed on Stem-O-Sphere's Instagram page! Overall, the aim of this project is to enable people to understand the importance of these viruses and their pathology through the use of art.

99. Gwyneth Phillips

Major: Human Physiology

Mentor: Gary Pierce (Health and Human Physiology)

Lower Vascular Endothelial Function is Associated with Increases in Diastolic Blood Pressure During Exercise in Individuals with COPD

Diastolic blood pressure (DBP) will normally stay constant or decrease slightly during exercise. Increases in DBP during exercise is considered an abnormal BP response and is associated with a heightened risk of cardiovascular disease (CVD), but the cause of this abnormal response is unknown. Individuals with lung disease (COPD) have lower endothelial function (a measure of vascular health) compared with individuals without COPD. However, it is not known if lower endothelial function is associated with an abnormal BP response during exercise in individuals with COPD. We hypothesized that lower endothelial function would be associated with an increase in DBP immediately following a six-minute walk test (6MWT) in individuals with COPD. Fifteen individuals with COPD (age 72+, 6; 6 males/ 9 females) completed brachial artery endothelial function measures and a 6MWT. Blood pressures were recorded before and immediately after the 6MWT. We found that lower endothelial function was associated with increases in DBP during exercise. These findings suggest that lower vascular health is associated with an abnormal DBP response during exercise in individuals with COPD, potentially explaining, in part, the higher CVD risk in this population.

101. Alexander Powers

Major: Computer Science and Engineering

Mentor: Hans Johnson (Electrical and Computer Engineering)

Data Augmentation for Deep Learning Image Segmentation

Supervised deep learning requires massive amounts of labeled data. It is often infeasible to label so much data, so one way to maximize the information we gain from each sample is to augment the existing data. In the case of medical imaging, we are able to apply a variety of image transforms (rotation, translation, scaling, distortion) in different permutations to drastically increase the size of the dataset. This augmented dataset helps us to generalize the problem we are trying to solve, as well as to prevent the overfitting of our model. I have found, however, that this augmentation is not a cure-all for the problems that small datasets present. The problem I evaluated was the segmentation of feeding and breathing tubes in pediatric X-ray images. The dataset consisted of 40 subjects, which was augmented to over 3000 images. Using a U-Net architecture for the image segmentation, I trained multiple models on different subsets of the augmented data. By systematically removing different images from the training data, I was able to interrogate the complexity of problem that could be solved using such a small dataset.

103. Erika Renkes

Majors: Biology, Spanish

Mentors: Hela Azaiez (Otolaryngology), Kevin Booth (Otolaryngology)

TJP2 Gene and Hearing Loss: Identification of a Novel Disease-Mechanism

Proteins form intricate networks that are fundamental to many cellular functions. In the inner ear, specific proteins called tight junctions are necessary for maintaining cell equilibrium. One of these key proteins is Tight Junction Protein 2 (TJP2) which has been previously linked to deafness through an overexpression mechanism. In this study, we aimed to identify the cause of deafness in a large Iranian family by using a sequencing platform that screens all known genes that cause deafness. We identified a mutation; c.2811+1G>A in TJP2 gene that was hypothesized to affect RNA splicing leading to a shorter protein. We tested this hypothesis by performing mini-gene assays in human cells to mimic the physiological conditions. Our results indicated a 10% loss of the length of the protein occurring in a domain that is involved in interaction with actin; a fundamental protein in cells in the ear. This is the first study showing that mutant TJP2 protein hinders the function of the normal protein in the TJ complex by altering its binding to actin. Understanding how mutations in a gene alter its function and lead to disease is fundamental to the creation of molecular therapies tailored to a patient's specific genetics.

105. Marissa Roseman

Majors: Biology, Environmental Science

Mentor: Maurine Neiman (Biology)

Genomic and Functional Tests of Mitonuclear Coevolution

Most proteins are encoded by DNA found in the cell's nucleus, but certain proteins are encoded by DNA found in a small ring in the mitochondria. Some of these mitochondrial genes encode pieces of proteins called protein subunits that combine with nuclear-encoded subunits to form a whole protein that works in the mitochondria. It is important that these subunits can still work together even when mutations alter them, so the mitochondrial and nuclear genes may co-evolve to preserve their function. Our research studies this mitonuclear coevolution using the New Zealand freshwater snail. This snail is a powerful model organism because it has populations that reproduce sexually and populations that reproduce asexually and consist of females producing clones of themselves. We hypothesize that more harmful mutations should accumulate in the asexual populations than the sexual populations because it is harder for natural selection to remove harmful mutations without also removing the helpful mutations. We want to determine whether higher mutation rates in asexual snails drive mitonuclear coevolution to preserve the function of mitochondrial proteins. Though the project is still in process, my poster presents our predictions and planned methods.

107. Chase Rourke

Major: Finance

Mentor: Jeffrey Hart (Finance)

Leveraging the Competition: How Wealth Managers Can Use Robo-Advisors to their Advantage

This paper investigates the threat of robo-advisors to the wealth management industry as trends show the increased propensity of the Millennial and Gen Z generations to migrate away from traditional financial advisors. It also presents potential topics for future research related to the matter. A primary goal of robo-advisors is to minimize costs and avoid conflicts of interest, all while appealing to a growing population of technologically savvy investors. Thus, consumer preferences, particularly those of the Millennial and Gen Z generation, and their willingness to "bare-all" to a computer-based algorithm lies at the center of the debate regarding the threat of robo-advisors to the wealth management industry, and what can be done by human advisors to adapt. This consumer willingness will be explored. Furthermore, in order for robo-advisors to subvert traditional financial advisors, they must achieve returns consistent to or greater than those of their human counterparts. This paper aims to summarize the arguments for and against the widespread use of robo-advisors, their potential to subvert their human counterparts, and the likelihood of younger generations to migrate towards these services through an expansive review of existing research on the subject.

109. Emily Ruba

Majors: Biology, Anthropology

Mentor: Diane Slusarski (Biology)

Modeling Bardet-Biedl Syndrome in the Zebrafish

Bardet-Biedl Syndrome (BBS) is a rare developmental disorder characterized by retinitis pigmentosa, a symptom which causes gradual vision loss in human patients. Genes that cause BBS also exist in zebrafish, so zebrafish can be used to model the development of BBS in humans. This project investigates the BBS12 protein, which is involved in development of photoreceptor cells, the cells that sense light in the back of the eye. If photoreceptor cells do not develop correctly or die prematurely, blindness will occur. This experiment investigated whether a BBS12 protein tagged with a green fluorescent protein marker, known as GFP, can be used to examine the role of BBS12 in zebrafish vision loss. To address this question, we used BBS12-GFP zebrafish to localize BBS12 in the zebrafish eye. Under a high-powered microscope, we observed expression of BBS12-GFP in the nuclear layer and the RPE layer of the zebrafish eye. We also used a behavioral assay to test zebrafish vision, and we found zebrafish with fluorescence in the eye can still see normally. This result supports the use of fluorescent BBS12 in future experiments, which will seek to link changes in localization of BBS12-GFP with loss of visual function.

111. Charles Ruff

Majors: Business Analytics and Information Systems, Finance

Mentor: Jeffrey Ohlmann (Management Sciences)

Optimizing NCAA Basketball Tournament Predictions

My research focuses on the NCAA March Madness men's basketball tournament to explore how simulation modeling and optimization techniques can be used for predictive analysis. Using a Monte Carlo simulation model based upon season long possession probabilities for each tournament team, my model predicts the outcome of each NCAA tournament basketball game. With the guidance of University of Iowa Analytics Professor Jeffrey Ohlmann, I examined the variables effecting each team's game statistics. I then use optimization to value these predictions using Las Vegas sports betting odds. Last year, my earlier version of the model predicted more tournament games than fifty competing college analytics teams. It will be interesting to see if my enhanced research model is more predictive of the 2019 NCAA men's tournament.

113. Jacob Sherman

Major: Psychology

Mentor: Jonathan Mordkoff (Psychological and Brain Sciences)

How Do We Process Irrelevant Information

In our everyday lives, we are constantly focusing our attention on different objects in the world around us. Even when attending to a certain object, there are characteristics about that object that we may not be attending to. How exactly do these irrelevant characteristics affect us and how exactly do our brains process information about these characteristics when we're not attending to them? In order to find out, we conducted an experiment in which participants would see a colored letter pop up on the computer screen, and be asked to press a button as a response. Half of the participants were asked to respond to whatever the color of the letter was, and half were asked to respond to the shape. Participants would respond with the left button for three colors or shapes, and would respond with the right button for the other three. In the experiment, certain shapes would appear more often with a certain color, while other combinations wouldn't appear at all. This was done so that participants would slowly start to associate the variable they aren't attending to with the variable they are answering for. The results for our first experiment showed that there was a more significant difference in reaction time for the subjects responding to shape than subjects responding to color when looking at differences in the irrelevant variable. One possible reason why this happened would be because our brains cannot process color before they process shape.

115. Jeffrey Shymanski

Major: Speech and Hearing Science

Mentor: Elizabeth Walker (Communication Sciences and Disorders)

Language-Dependent Factors Affecting Sequential Learning in Children

Sequential learning is a general learning tool that allows the brain to extract meaningful patterns of language during speech perception. Children born deaf lack early access to spoken language, and some research suggests this period of deafness delays sequential learning development. The current study investigated how linguistic learning strategies (e.g., verbal mediation—the mental rehearsal of verbal information) may support or restrict sequential learning depending on task demands. This study addresses three questions: (1) is sequential learning impacted when task sequences can be easily verbally mediated, (2) does verbal mediation affect declarative recall of these sequences, and (3) do cognitive/language skills predict sequential learning? We assessed cognitive/language skills as well as sequential learning in 25 children with normal hearing. Children completed two sequence learning tasks, which either included or excluded easily verbalized stimuli. Results indicated significant learning on the nonverbalized but not the verbalized task. There were no significant differences in participants' abilities to recall verbalized and nonverbalized sequences. Only vocabulary size predicted sequential learning; children with larger vocabularies performed more poorly on the verbalized task. These results suggest that statistical learning and language-dependent learning compete, justifying further study of verbal mediation and sequential learning in children with hearing loss.

117. Maggie Sodders

Major: Biology

Mentor: Toshihiro Kitamoto (Anesthesia)

Identifying Possible Epilepsy Genes in a Fruit Fly Model of Epilepsy

Epilepsy impacts more than 65 million people worldwide, making it one of the most common neurological disorders seen today. There are effective anti-epileptic drugs, but nearly 30% of patients do not properly respond to these drugs, creating an urgent need for new ways to control epilepsy. With this as a long-term goal, our lab carried out a genome-wide genetic screen to search for genes that can modify seizure-like characteristics of a fruit fly mutant, Shudderer (Shu) - a fly model for human epilepsy. Our extensive genetic screen, examining more than 300 deficiencies, led to the identification of several chromosome regions that may potentially contain genes that modify our mutant's epilepsy-like behavior. Furthermore, we were also able to narrow down one such region to a genomic fragment on the 2nd chromosome of the fly, where approximately twenty-three genes reside. In the current project, we inactivated fourteen genes individually to see how epilepsy-like traits would change without a specific gene's expression. We identified at least three genes, Chd1, α 4GT1 and SerRS, which appear to play important roles in the exhibition of the epilepsy-like behavior. These findings open up a new area for discovery for treatment of epilepsy.

119. Matthew Sovers

Major: Environmental Science

Mentor: Betsy Stone (Chemistry)

Effects of Burning Alternative Fuels on Emissions to Understand its Impacts on Air Quality

Poor air quality is the third leading cause of premature death in the world. Sources of particles in the air we breathe such as those from industry contribute to our environmental impact and may negatively affect air quality. Burning alternative fuels such as plant materials or recycled material along with coal decreases emissions of fossil CO₂ and may reduce particulate matter and metal emissions. This study looks to investigate the emissions of burning different alternative fuels, an 83% biomass blend with coal, and 100% recycled material called energy pellets. By collecting and determining emissions from the plume of the plant, reductions in airborne particle and metal emissions when burning plant materials along with coal were observed. When burning energy pellets alone, metal and fossil fuel carbon dioxide emissions were reduced however, particulate matter emissions were increased. While utilizing alternative fuels to fulfill energy needs, it is important to investigate its impact on air quality.

121. Jessica Spinelli

Major: Speech and Hearing Science

Mentors: Kristi Hendrickson (Communication Sciences and Disorders),
Elizabeth Walker (Communication Sciences and Disorders)

The dynamics of spoken word recognition in the presence of soft speech

The process of recognizing spoken words is a challenging task. Words unfold over time, meaning each word is heard sound by sound in the order they are presented. For example, if the word is "red", the listener would first hear /r/, then /E/, then /d/. There are also many words that sound the same which creates uncertainty for listeners. For example, "red" shares the first sound with "rope" and shares the last two sounds with "bed". These overlapping sounds make it challenging for listeners to identify what word was heard. The task of recognizing words is even more challenging when presented with speech that is reduced (i.e., soft speech). Little is known about how normal hearing listeners process soft speech. Recognition of soft speech is an important task for listeners because it is ever present in our society, such as when a speaker whispers or two individuals are speaking from a distance. This study uses an eye-tracking task to determine how listeners recognize speech as it unfolds.

123. Sidney Spurgeon

Major: Chemistry

Mentor: Renee Cole (Chemistry)

Characterization of Student Interactions in Introductory Chemistry Courses

Studies have shown that small group discussion amongst students can positively impact their conceptual understanding of material and improve critical thinking,

problem solving, and communication skills. However, placing students in a group setting does not necessarily promote productive discussion or knowledge development. This research investigates the nature of student conversation and small group participation in general chemistry lectures and discussions, and the overall aim is to observe how students articulate chemical concepts and determine patterns that are present in the discourse. This is done by analyzing the student conversations in terms of the types of interactions and the purpose of the contributions made to the discussion. We hope that the results from this study will inform future educators in how to promote productive conversations between students when working in small groups.

125. Samantha Stoll

Major: Psychology

Mentor: Isaac Petersen (Psychological and Brain Sciences)

Do parenting behaviors predict children's delay of gratification through hot and cool delay strategies?

It is important for children to develop the ability to suppress dominant impulses in order to gain larger rewards in the future (delay gratification). For example, children must prevent themselves from spending their allowance each week in order to save their money for a larger gift. When trying to resist temptations, children engage in a variety of strategies. Strategies may include paying attention to the reward (hot focus) or engaging in a distracting activity (cool focus). My thesis examined whether parenting behaviors predict children's ability to delay gratification through the delay strategies children use. To answer this question, 55 children, ages 3-6 years old, were observed in a waiting task and given the option between waiting to receive a large plate of treats or to immediately receive a smaller, less desirable, treat. Results did not support the proposed association between parenting behaviors, delay strategies, and delay ability. However, older children were more likely to employ cool strategies and less likely to employ hot strategies (compared to younger children), suggesting a developmental progression in the strategies children employ. Overall, findings indicate a new perspective on the role parents play in the development of children's self-regulation abilities.

127. Avery Stricker

Major: Neuroscience

Mentor: Nicole Becker (Chemistry)

Undergraduate Chemistry Students' Epistemic Ideas about Models and Modeling

In chemistry, scientific models such as molecular level formulas, graphs, and mathematical equations play important roles in predicting and explaining chemical phenomena. Understanding what a scientific model is and how models are developed is important for undergraduate chemistry students' understanding of and ability to use important chemical models. However,

research shows that students do not always develop expert-like understandings of different kinds of models. Here we report findings from a survey of students' reasoning about models generally and in some specific contexts within the general chemistry curriculum. The findings suggest that students have some productive ideas about what makes something a "good" scientific model and the changeability of those models; our findings highlight the ways students' ideas develop and suggests ways that instructors can build upon students' own ideas when scaffolding instruction.

129. Sarah Stueve

Major: Biology

Mentor: Rhonda Souvenir (Internal Medicine)

Deletion of UCP-2 from Platelets Reduces Blood Clotting

Many prevalent cardiovascular diseases are caused by inappropriate blood clotting. It was found that people who were at higher risk of cardiovascular disease had higher levels of a protein called Uncoupling Protein 2 (UCP-2) in their platelets, which are cells in the blood that are responsible for producing clots. We want to understand whether these increased levels of UCP-2 is contributing to these people's risk for cardiovascular disease or is an attempt by the body to fight against it. To study this, we used gene editing techniques to create mice that do not produce UCP-2 in their platelets.

We found that the platelets without UCP-2 were less likely to activate, an important step in forming a clot. We also found that mice without UCP-2 took longer to stop bleeding after their tails were cut and were less likely to form a clot than normal mice. These results suggest that people with increased UCP-2 in their platelets would be more likely to form clots, putting them at higher risk for cardiovascular disease.

131. Alexandria Sturtz

Major: Microbiology

Mentor: Noah Butler (Microbiology and Immunology)

Therapeutic strategy for boosting resistance to repeated malaria parasite infections

Despite decades of research worldwide, malaria, a parasitic bloodborne disease, still causes nearly half a million deaths each year. This is in part due to the delayed acquisition and low quality of anti-malarial immunity, which leave people vulnerable to repeated bouts of malaria. To try and elicit protection against repeated parasite exposures, as is characteristic in endemic regions, we repurposed a cancer immunotherapy (3H3) for use during experimental malaria. Unexpectedly, we found that 3H3 treatment exacerbated the parasite burden during an initial infection but showed enhanced protection upon re-infection with a lethal strain of the parasite.

To mitigate the high parasite burden during the initial infection following 3H3 treatment, we gave 3H3-treated mice a known anti-malarial drug. Mice treated with 3H3 and the anti-malarial drug controlled the initial infection and still retained increased resistance against a lethal reinfection. Our results suggest the possibility of 3H3 and known anti-malarial drugs as a combinational therapy to elicit protection against repeated parasite exposures. Experiments are underway to define the mechanism by which 3H3 modulates the immune system to induce resistance following re-infections.

133. Hailee Talbot

Major: Human Physiology

Mentor: Kara Whitaker (Health and Human Physiology)

Provider Advice and Women's Physical Activity and Dietary Behaviors in Twin Pregnancies

OBJECTIVE: To determine the content and accuracy of health care provider advice on physical activity and dietary behaviors of women pregnant with twins.

METHODS: Mothers of twins completed an online survey about the conversations they had with their providers during their twin pregnancy. The responses were examined and sorted into different themes based on their relation to physical activity or healthy eating.

RESULTS: The survey was completed by 301 women who delivered twins in the last three years. Approximately 70% of women reported receiving provider advice on physical activity and nearly 60% reported advice on healthy eating during their twin pregnancy. Of those reporting advice on physical activity, few women received advice on physical activity frequency and duration, but nearly half received advice on physical activity intensity. Nearly 40% of women were recommended to restrict their physical activity during their twin pregnancy. Of those reporting advice on healthy eating, women most commonly reported being told to consume a balanced, healthy diet and to increase protein intake.

CONCLUSION: Many women are receiving broad, elementary advice (if any) from their providers in regard to physical activity and dietary behaviors during a twin pregnancy.

135. Hanxi Tang

Major: Biology

Mentors: Toshihiro Kitamoto (Anesthesia), Junko Kasuya (Anesthesia)

Commensal Bacteria Increase Severity of Seizure-like Phenotypes in Drosophila Voltage-gated Sodium Channel Mutants

Recent studies have shown that a complex, two-way communication exist between the diverse community of gut microbes and the brain. However, it remains largely elusive how the brain interacts with microbes in the gut and influence their biological activities. To address this issue, we take advantage of a sodium (Nav) channel mutant (Shudderer) of the fruit fly *Drosophila melanogaster*. Sodium channels are critical for nervous system function and play a central role in conducting action potentials. We examined the extent to which

gut microbes contribute to the manifestation of seizing behaviors in Shudderer. Removal of prokaryotic microbes from the gut during the larval stage significantly attenuated neurological defects in this mutant. Conversely, re-introduction of single commensal bacterial species into germ-free mutants exacerbated the severity of the defects, indicating that indigenous prokaryotic microorganisms contribute to Shudderer neurological defects. These findings set the foundation for further exploration of the functional interactions between the brain and gut microbiota using a variety of experimental tools available in *Drosophila*.

137. Maegan Tyrrell

Major: Health Promotion

Mentor: Jon Winet (Art and Art History)

Leadership Development Through Undergraduate Peer Mentoring

The Passport Project is a First-Year seminar dedicated to introducing students to the cultural and scholarly offerings of The University of Iowa and Iowa City. Students earn visa stamps by attending events in seven categories - social sciences, visual arts, etc. Large group lectures are complimented with Breakout sessions led by undergraduate Peer Mentors.

At the beginning of the Fall 2018 semester, 10 undergraduate Peer Mentors were administered the self-evaluation portion of the Student Leadership Competencies 360 Degree Evaluation. The evaluation was repeated at semester's end. To further understand the development of each Peer Mentor's leadership abilities, five follow-up questions were asked. The responses will help assess the impact of participating in a peer mentorship and how it informs other aspects of the undergraduate experience. Additionally, the responses will measure the range of skills learned throughout the peer mentorship and if the Peer Mentor has subjectively experienced any growth in their leadership development.

139. Kimberly Vencer

Major: Human Physiology

The role of the dorsal raphe nucleus in regulating brain activity following seizures

Epilepsy is a neurological disorder characterized by spontaneous seizures. Sudden unexpected death in epilepsy (SUDEP) is the leading cause of death in patients with uncontrolled seizures. The cause of SUDEP is unknown. A potential risk marker for SUDEP is the duration of post-ictal electroencephalographic (EEG) suppression (PGES), a period of low brain activity following seizures. The mechanism underlying PGES is unknown. Since the signaling molecule serotonin (5-HT) is implicated in SUDEP, we hypothesized that 5-HT is involved in modulating PGES. The dorsal raphe nucleus (DRN) is a major source of 5-HT projections and is dysregulated by seizures. Preliminary studies suggest that focal chemical stimulation of the DRN reduces PGES duration. We hypothesized that a broader light stimulation

of DRN 5-HT neurons could decrease PGES duration. To test this, mice expressing light-sensitive proteins were instrumented with EEG/EMG electrodes to record brain activity, an amygdala electrode to render animals seizure-susceptible, and a DRN optic fiber. Animals recovered from surgery and received DRN light stimulation 10 minutes prior to seizure induction. Pre-seizure light stimulation reduced PGES duration in mice. Future experiments could address the role of 5-HT in PGES in structures downstream of the DRN, such as the hippocampus, a common epileptogenic zone.

141. Shangguan Wang

Major: Business Analytics and Information Systems

Mentor: Kang Zhao (Management Sciences)

Link Predictions For Social Networks In an Online Health Community

Online social networks are ubiquitous in our daily life and offer different ways for people to interact with each other. Link prediction aims at predicting potential future social connections or interactions between two users within a social network. Our project implements different link prediction algorithms and evaluates their performance for online social networks among users of an online health community for smoking cessations. The social networks were based on users' online interactions via four communication channels: blog comments, message boards, group discussions and private messages. The outcome of this study will help to provide insights into the design of recommender systems in such online social networks, and to improve user experience and engagement in online health communities.

143. Jiahua Zhang

Majors: Computer Science, Statistics

Constrained Procedural Level Generation using Graph Theory

Procedural level generation is a method of creating game levels algorithmically rather than manually, with the aim of providing a larger variety of content that would be infeasible to produce by hand. However, one major issue is while each generated output may be unique, they look functionally similar the other outputs. This means that the player may not notice a significant difference, undermining the purpose of procedural generation. In this paper, we propose an algorithm to convert a graph into a level, which allows us to evaluate the underlying graph to determine how different two levels are. This provides a method for a procedural generation algorithm to reject a level if it is too similar and create a larger variety of distinct content.

145. Lexi Zocher

Major: Human Physiology

Mentor: Gordon Buchanan (Neurology)

Potential Brain Region Activation Pathway of CO₂-Induced Arousal System

An increase in carbon dioxide levels in the bloodstream causes one to wake up. This is an important protective mechanism that is dysregulated in certain syndromes and

disorders. Serotonin, a brain signaling molecule, is important in this process. In this experiment, we aim to determine the pathway of this arousal system. Two groups of mice, one expressing serotonin neurons and the other deficient in serotonin neurons, were exposed to CO₂ using two different mechanisms. One mechanism involved breathing CO₂, the other involved perfusion of CO₂ in the form of artificial cerebrospinal fluid directly into a nucleus of the brain known to be important in this arousal system. Immediately following exposure, animals were euthanized and their brains collected for processing to identify activated neurons. The most active brain regions are likely to be most important in CO₂-induced arousal.

149. Carolyn Lo; Alex Syverud

Systematic Optimization of Nanopore Based Next-Gen Sequencing

Majors: Human Physiology, Biochemistry; Public Health

Mentor: Jacob Michaelson (Psychiatry)

DNA sequencing is the process of determining the order of nucleotides in nucleic acid sequences. The order of nucleotides is unique to every person. Sequencing data can be useful in a number of situations such as when identifying disease causing mutated regions or determining an individual's risk for developing a particular health condition. New sequencing devices such as the MinION, by Oxford Nanopore Technologies, have allowed for more accessible rapid genome sequencing. This handheld device has the potential for fast real time data at a fraction of the cost of traditional next-generation sequencing. However, the MinION is a new tool and not a lot of data exists regarding the ideal conditions for use. In our study, we examined how effective the MinION is in reading different qualities and lengths of DNA. We varied the starting conditions for DNA and hypothesize that shorter (8kb) DNA treated with Rnase and at a high starting concentration will show the highest quality reads. Knowing this information will help us proceed further with the MinION and obtain the best sequencing results possible.

Second Hour Presenters

5:30-6:30PM

(even numbers only)

2. Holly Alessio

Major: Nursing

Mentor: Wen Liu (Nursing)

Characteristics of Mealtime Nonverbal Behaviors among Residents with Dementia who are Assisted by Nursing Home Staff

Nursing home residents with dementia commonly experience functional and behavioral difficulties at mealtimes. This can lead to a loss of functional independence and have negative nutritional outcomes. There is relatively little research published on the relationship between nursing home residents and feeding assistants, and caregiver training is predominantly limited to spoon-feeding instruction. In order to examine the characteristics and patterns of resident interactions, as well as the impact on resident function and nutrition, a coding scheme of resident mealtime nonverbal behaviors was developed and established with feasibility. Specific negative and positive resident nonverbal behaviors were coded using 160 mealtime videos that involved 27 residents in 9 nursing homes with 36 feeding assistants. Descriptive and inferential statistics were used to determine the significance of the behavioral data collected. There was a significant difference in resistive behaviors in residents assisted by staff compared to residents who eat without assistance. There was also a larger percentage of resistive behaviors in female compared to male residents, as well as residents with female compared to male feeding assistants. However, there was insufficient evidence to conclude that significant differences exist between these data sets.

4. Kirsten Anderson

Major: Biomedical Engineering

Mentor: Jason Wilken (Physical Therapy and Rehabilitation Science)

Characterization of a Novel Shoe Testing Method for use in Custom Orthotic Device Evaluation

Carbon Fiber Custom Dynamic Orthoses (CDO's) have shown improved function after high energy limb trauma [1, 2]. Device alignment, heel cushion height and stiffness directly influence limb loading and patient's perception of device function [3, 4]. Device alignment and heel cushioning are influenced by the shoes worn. Expensive mechanical testing systems, not located within the gait laboratory, are used to evaluate mechanical shoe characteristics. A low-cost, portable, and easy-to-use system for testing shoes in the gait laboratory

would expedite studies aimed at evaluating interactions between footwear and device function. This study was conducted to develop a mechanical testing system, and to evaluate between side differences in shoe compressed height, change in height with compression, initial and late stiffness. Between side differences were below one millimeter for displacement measures, and less than 15% for stiffness measures, suggesting adequate consistency and the ability to test a single side in future studies.

6. Sameer Ansari

Major: Human Physiology

Mentors: Santiago Ortega (Neurology), Andrea Holcombe (Epidemiology)

Analysis of Different Imaging Protocols for Endovascular Thrombectomy Patients

The purpose of this research project was to compare different imaging protocols (MRI, CT, Direct to Angiosuite) and their effect on time to surgery and clinical outcomes of endovascular thrombectomy patients.

8. Jennifer Banks

Major: Environmental Anthropology

Mentor: Matthew E. Hill (Anthropology)

Housing on the Great Plains

Ancestral Apache sites located in the eastern Central Plains of Kansas and Nebraska date to AD 1500-1800, and are frequently associated with small, circular wickiup house structures. A number of these localities have a high degree of preservation that allows for a detailed study of the architecture and construction techniques of these people. This poster will summarize published data and results from recent fieldwork to provide insight on the household size and structure of the Great Plains Region. This study will allow us to compare data from new finds to data from previously excavated sites. Because the presence of Apache groups on the central Great Plains is part of a larger migration involving many different groups, we hope that the study of ancient household architecture can tell us something about past social landscapes.

10. Jayden Bisson

Majors: Human Physiology, Asian Languages and Literature

Mentor: Stacey DeJong (Physical Therapy and Rehabilitation Science)

Use of technology to enhance rehabilitation of an individual with chronic incomplete spinal cord injury: a case study

Current methods of alleviating difficulties associated with spinal cord injuries (SCI) often fail to produce significant results, especially in chronic stages of recovery. Technology offers an alternative method of motor training with immense potential, as it allows physical therapists to increase motivation and functional outcomes by providing immediate visual feedback and goal-

oriented tasks to patients.

In order to explore technology-based methods, we developed a strength and motor control training computer program in which a subject with chronic SCI moved his wrist against a custom force-measuring device, using force generation to follow a target line on a computer screen. After 24 sessions the subject's motor performance in the novel task improved, active range of motion was enhanced, and strength increased. Using transcranial magnetic stimulation, which activates neurons, we were able to analyze brain connections by measuring muscle responses. Before the training program muscle responses could not be elicited, but afterwards responses were elicited in 4 muscles, including the extensor muscle we trained.

Overall these results show that computer programs allowing therapists to develop individualized software catered to their patient's specific needs and brain stimulation devices allowing them to assess the level of corticomotor connectivity are both practical alternatives to current practices.

12. Eva Bowles

Major: Biochemistry

Mentor: Terry Wahls (Internal Medicine)

Dietary Changes and Improvement in Lifestyle

Multiple Sclerosis, an autoimmune disease that attacks the brain and spinal cord, affects millions of people. Many people modify their diets in hopes to manage their symptoms. In this study, we compare the effects of two diets. The Wahls Elimination Diet eliminates eggs, dairy, and grains while promoting vegetables and organ meats. The Swank diet emphasizes the consumption of 4 servings of grains while limiting the consumption of saturated fats to less than 15 grams a day. Eligible patients have relapsing-remitting multiple sclerosis and moderately severe fatigue. During the first 12 weeks, the participant will continue to follow their usual diet. At 12 weeks the participant is randomized and trained to adopt and sustain the assigned study diet. The participant returns at week 24 and week 36. Fatigue scores, quality of life, walking function and dietary measures (weighed food records and food questionnaires) are completed at baseline, weeks 12, 24, and 36. It's thought that the Wahls diet group will experience significantly more fatigue reduction and greater improvements in overall nutrition quality than the Swank diet group. WE will report the average characteristics of participants at enrollment. Analysis will be completed at the end of the study.

14. Alexis Brannan

Major: Human Physiology

Mentor: Terry Wahls (Internal Medicine)

Nutritional Profiles of Diet in Individuals with MS following a Intervention Modified Paleolithic Diet

Multiple Sclerosis is an incurable that causes a breakdown of the central

nervous system in the body. This results in impaired motor and cognitive functioning, fatigue, and pain. Former research studies have found that it's possible diet can have a stronger correlation to negative side effects of the disease than does genetics. The correlated clinical study has shown a statistically significant reduction of fatigue and quality of life after diet change. Now I report the nutritional intake values of the involved MS participants following a modified Paleolithic intervention diet (no grain, legumes, dairy, high vegetables). A food frequency questionnaire asking participants to identify how often they eat a variety of foods were given at baseline and 12 months and used to calculate nutrient intake. Detailed daily food logs were kept in order to assess diet adherence. Results indicated an overall improvement in diet quality as there was a significant increase in desired fiber, omega 3, and antioxidant intake paired with a decrease in undesired total calories, glycemic index, and saturated fat.

16. Lauren Brown

Major: Speech and Hearing Science

Mentor: Anu Subramanian (Communication Sciences and Disorders)

How do students learn to become empathetic clinicians

The therapeutic alliance is the overall relationship between a client and a clinician and includes agreement on the goals of therapy and techniques used in therapy. This alliance is a factor that has been found to predict positive outcomes across varying types of therapy. Although the clinician-client alliance is considered a key element of the therapeutic process there have been no investigations into how this is taught and learned in the clinical education of speech-language pathologists. This study attempts to expand on this topic by analyzing the teaching/learning of the therapeutic alliance in the clinical education of graduate students in the field of speech-language pathology. This was done through the use of individual surveys for the graduate students working in the clinic and their supervisors in the clinic. The questions in the surveys focused on their understanding of the therapeutic alliance, teaching/learning of the therapeutic alliance, teaching/learning of other clinical skills, and clinical feedback. The data collected from this study can help us to better understand how aspects of the therapeutic alliance are taught in the clinical education of speech-language pathology graduate students which can lead to more positive experiences for graduate students, clinical supervisors, and future clients.

18. Travis Carter

Major: Criminology

Mentor: Mark Berg (Sociology)

Analyzing the underlying mechanisms of alcohol-related violence

The primary goal of this study is to test if the consumption of alcohol is associated with the occurrence of violent incidents during conflicts. The second goal is to test underlying mechanisms that might explain this

relationship. I do this by analyzing the effects of receiving apologies, threats, provocations, and consuming alcohol on the likelihood of a violent outcome occurring during a conflict. For the analyses I rely on original data collected from a sample of inmates and their contacts in the community pertaining to their involvement in violent and non-violent disputes. The initial results reveal a positive association between alcohol and violent incidents. The results from subsequent analyses reveal that alcohol-related violent incidents occur less frequently when apologies are issued. Alcohol-related violent incidents occur more frequently when provocations are issued. The results suggest apologies might serve as inhibitory cues and suggest provocations function as disinhibitory cues when disputants consume alcohol.

20. Shangwen Chen; Shuhui Gao; Zihao Li; Shuhao Liu

Majors: Computer Science, Mathematics; Mathematics; Mathematics; Computer Science

Mentor: Isabel Darcy (Mathematics)

Shortest Distance in Beijing Subway System

In this research paper, we are going to focus on the graph theory by converting the real-life subway system problem into the graph theory problem. We would label the subway stations as vertices, subway routes as edges, and transfer them into a graph. Through using the shortest path theory to calculate the minimum time and distance between two subway stations.

22. Geoff Collins

Majors: Biochemistry, Computer Science, Spanish

Mentor: David Price (Biochemistry)

Quantifying the Effects of Human Cytomegalovirus Infection on Host Transcription

Human Cytomegalovirus (HCMV) infects about half of the United States population and leads to diseases and birth defects. The virus is transcribed by RNA polymerase II under the influence of host and viral factors. Understanding how transcription of the virus is regulated has been dramatically improved with global transcriptional analyses using PRO-Seq in the Price Lab. Results from PRO-Seq experiments examining a series of datasets collected during a time course of HCMV infection of primary human fibroblasts were analyzed to determine the changes in the positive transcription elongation factor, P-TEFb-dependent productive elongation through the bodies of genes in the host and virus. This analysis led to a new method to quantify the amount of amount of productive elongation addressing two main problems: promoters entering gene bodies and small RNA genes inside larger gene bodies. Blacklists identifying promoters and small RNA genes were made to remove data from regions in the genome affected by these issues, leading to a decrease in the calculated fold changes and providing a more realistic quantitation of transcription changes. This method can be easily modified to analyze transcription across any annotated genome from datasets generated using similar sequencing methods.

24. Greg Collins

Major: Human Physiology

Mentor: Helena Kenny (Internal Medicine)

Inducible Deletion of OPA1 in the Heart Induces ER stress that Precedes Mitochondrial and Contractile Dysfunction

Heart failure is a major health problem affecting 23 million people worldwide. Mitochondria are important double membrane organelles, that when subjected to cellular stress can contribute to the progression of heart failure. They constantly undergo the processes of fission whereby they divide, forming smaller mitochondria and fusion where they combine to form larger mitochondria. Outer mitochondrial membrane fusion is regulated by MFN1 and MFN2. Inner membrane fusion is regulated by OPA1. Fission is mediated by DRP1. Imbalanced mitochondrial dynamics may lead to mitochondrial dysfunction, reduced cardiac function and death. This study will investigate if the knockout of OPA1 will compromise mitochondrial function leading to a reduced cardiac function and ultimately death. We will investigate if altered mitochondrial dynamics in the presence of OPA1 KO leads to ER stress. To reduce the burden of heart failure, it is imperative that we gain a better understanding of the underlying cellular and molecular mechanisms involved. Mitochondrial dynamics has emerged as an important mechanism to maintain cardiomyocyte integrity. This study will investigate the importance of balanced mitochondrial dynamics in maintaining cardiac function.

26. Ellyn Cramer; Tashmit Khan

Majors: Biology; English

Mentor: Chun-Fang Wu (Biology)

How Does Lighting Modulate Male-Male Interaction in Fruit Flies?

Animal propagation depends on individual interactions within the population. Many types of interactions among individuals can be modulated by environmental factors to influence the propagation of a species. Several forms of male-male interactions have been observed in fruit flies. We investigate how "oxidative stress" and lighting conditions affect behaviors between male flies. Oxidative stress is created by reactive oxygen species (ROS) that are produced during normal aerobic respiratory processes that must be efficiently cleared to prevent oxidative damage of the cell, the most general cause of aging and neurodegenerative diseases. Superoxide dismutase (SOD) is the ROS scavenging enzyme, SOD mutations of flies (Sod) exhibit shortened lifespans associated with neurodegeneration. Our previous studies have demonstrated a striking "helper" effect that doubles the lifespan of Sod flies when co-housed with active "helpers," normal wild-type (WT) flies. We observed male-male chasing behavior between co-housed WT flies and Sod mutant flies. We also observed an enhancement of male-male chasing among WT flies under strong illumination. We are investigating how light intensity modifies the interaction between WT flies and how illumination modifies the WT helper behavior towards Sod flies to modulate the "helper" effect.

28. Genna Crom

Major: Physics, Astronomy

Mentor: Cornelia Lang (Physics and Astronomy)

Galactic Center Radio Lobes; Is Energy Being Driven From The Center Of Our Galaxy?

The Galactic Center Lobes are large scale "bubble-like" structures extending out perpendicular to the galactic disk up to 50,000 light-years. Using the Very Large Array Radio Telescope in New Mexico, we are looking for low-level radio emission that may be associated with an outflow of material from the Galactic Center. This "driven outflow" may be very high energy electrons stemming from star forming regions from the Galaxy's central 650 light-years, and is thought to be transporting large amounts of energy into the Galactic Halo. We are also interested in determining the morphology of the magnetic field in this region, and whether it is continuous with that of the lower latitudes' magnetic field, allowing us to understand more about how our galaxy may have been formed. We identify several point sources both in the infrared and our own observations.

30. Zachary Dierks

Majors: Anthropology, History

Mentor: James Enloe (Anthropology)

A Legacy Etched in Stone: An Examination of Lithic Technology at Woodpecker Cave

This is an examination of the lithic technology present at Woodpecker Cave. Lithics are stones modified by humans that include finished points, the leftovers created when in the production process of making finished tools, and other forms of human modified stone technology.

32. Gabrielle Duncan

Majors: Cell and Developmental Biology, Human Physiology

Mentor: Gen Shinozaki (Psychiatry)

Epigenetics of Delirium and Aging

Delirium is a sudden change in mental state with severe confusion and impaired brain function. It is common in elderly patients, and it is dangerous because it leads to increased mortality. The pathogenesis of delirium is not well understood, but major risk factors include aging and exogenous insults such as infection or surgery which release pro-inflammatory cytokines. Older individuals may have DNA methylation changes that influence increased cytokine release upon insult, which may lead to delirium. Our goal is to find an epigenetic biomarker that can identify individuals susceptible to delirium. In the Department of Psychiatry at UIHC, the relationship between aging and epigenetic marks on DNA (DNA Methylation) of pro-inflammatory cytokine genes was investigated. The results showed strong associations between aging and decreases in DNA methylation levels of cytokine gene CpGs in glia and blood which may influence the pathogenesis of delirium.

34. Erick Fadness; Camryn Norton

Majors: Environmental Science; Environmental Engineering

Mentor: Scott Shaw (Chemistry)

Using Oxygen-Bomb Calorimetry to Determine Maximum Efficiency in Ethanol Blends and Regular Unleaded Gasoline

The comparison between gasoline and ethanol continues to be in the public eye. Ethanol is appealing because it is less expensive than regular gasoline. Some studies have found that ethanol is also better for the environment. Though there are many studies into how ethanol is better emission wise, there really isn't anything that compares unleaded gasoline's energy in and out efficiency to that of ethanol. To accomplish this, different samples of ethanol and unleaded gasoline will be ignited in an oxygen-bomb calorimeter. This calorimeter contains 20 atmospheres of pure oxygen to simulate an ideal environment for combustion. The heat from the ignition will then transfer to the water surrounding the device. This temperature change will then be measured by digital probes. Though experiments like this have been done before, this sort of research is extremely relevant to the state of Iowa, because ethanol is a growing part of the economy. As concerns for depletion of fuel grows, it's important to determine which source is ultimately the most energy efficient.

36. Emma Fenstermaker

Majors: Sociology, English and Creative Writing

Mentor: Alison Bianchi (Sociology)

Model Minority Myth?: Men and Women during Interaction Using an Expectation States Approach

For this project, I conducted a social psychological experiment at The Center for the Study of Group Processes to study the relative influence people possess in group tasks based on characteristics, such as race/ethnicity or gender. The subject pool was made up of White female undergraduates at The University of Iowa, and the goal of the study was to discover whether and to what extent White females defer to White, Asian, and Asian American men in task groups. The study was motivated by Status Characteristic Theory, which posits that group hierarchies form when individuals assume that their fellow group members are more or less competent compared to themselves. The preliminary results show that women defer to Asian American men the most, followed by White men, and that they least defer to Asian men.

38. Sarah Francisco

Majors: Marketing, History

Mentor: Andrea Luangrath (Marketing)

Virtual Reality and Ease of Haptic Imagery

As retailers expand their Internet presence, the usefulness of touch and the need to create haptic exploration opportunities for consumers have come to the

forefront. Virtual reality and haptic imagery, the mental visualization of touch, have been suggested as potential solutions to the problem of lack of touch in online shopping. Haptic imagery has been shown to produce the same psychological effects as actual touch, such as higher perceived ownership of products. While there is limited research on virtual reality in a marketing context, its immersive effects create a promising potential for its utility in online retail. However, the question of whether virtual touch helps individuals imagine themselves touching products, or producing haptic imagery, has yet to be investigated. This research explores whether virtual touch facilitates individuals' ability to imagine themselves touching a product. We find that virtual touch does lead to greater ease of haptic imagery. In addition, we show that this effect does not depend on individuals' preference for haptic information.

40. Danielle Funaro

Major: Human Physiology

Mentor: Terry Wahls (Internal Medicine)

Recruiting Participants for the Dietary Approaches to Treat Multiple Sclerosis Related Fatigue Study

Background: Multiple Sclerosis is an autoimmune disease that affects approximately 2.3 million people world-wide, often resulting in difficulty with walking, thinking, vision, and fatigue. The Dietary Approaches to Treat MS Related Fatigue Study will compare two diets popular within the MS community and determine which leads to greater improvements among these symptoms. Materials and Methods: Participants of the study must have Relapsing Remitting Multiple Sclerosis and fatigue. Participants undergo 4 visits over the course of 36 weeks and eat their usual diet during the first 12. After which, participants are randomly placed on either the Wahls or Swank diet. Each participant's fatigue levels, mood and thinking ability, motor function, and cholesterol are assessed at baseline, weeks 12, 24, and 36. Diet quality is assessed using a 3 Day Weighed Food Record and the Harvard Food Frequency Questionnaire. Results: We are unable to analyze results until the study is completed and will therefore provide baseline statistics from visit one data. Conclusion: The study will assess the impact of adopting the Swank and Wahls diets on fatigue and quality of life among individuals with Multiple Sclerosis.

42. Lauren Gentile

Major: Classical Languages

Mentor: Adam Hooks (English)

"Venus and Adonis" Myth: Two Interpretations

For those who don't read Latin, but who want to understand how Shakespeare may have sampled from Ovid's "Metamorphoses" in his construction of his narrative poem "Venus & Adonis," we have compiled a database that allows

direct comparison between Shakespeare's original English text and Ovid's original Latin text. With translation notes, source study scholarship, and a searchable interface, this allows for direct comparison between the two iconic poems.

44. Nicholas Grandstaff

Major: Economics

Mentors: Anne Villamil (Economics), Mahdi Eghbali (Economics)

Sectoral Growth and its Effect on SBIR Grant-Receiving Firms from 1987-2017

In an effort to bolster innovation among small firms in the United States, the U.S. Small Business Administration began offering competitive grants to small firms as part of the Small Business Innovation Research (SBIR) program. The program partners with other government agencies to allocate remaining research funds to small firms seeking to engage in private sector research that would otherwise be costly and risky to undertake by a young and/or small firm. My research considers the firm and market conditions of former (and current) grant recipients and how those firms' characteristics might guide inform future decisions on what characteristics a successful SBIR might possess.

46. Cameron Hauser

Major: Human Physiology

Mentor: Gordon Buchanan (Neurology)

The importance of the locus coeruleus for waking up to increased CO₂ in the blood

CO₂-induced arousal is a protective mechanism which allows for the detection of increased CO₂ in the blood and signals for arousal from sleep to prevent CO₂ from building up to harmful levels. This process may be involved in conditions such as sudden unexpected death in epilepsy (SUDEP) and sudden infant death syndrome (SIDS), where failure to arouse to increased CO₂ could contribute to death. Despite its importance, mechanisms for CO₂-induced arousal are not fully understood. Determining the structures involved could provide insight on the malfunctions occurring in these conditions. Previous research has shown that a brainstem structure known as the dorsal raphe is necessary to wake up to increased CO₂ in the blood. We hypothesized that this process occurs through the dorsal raphe signaling to another brainstem structure, the locus coeruleus, to cause arousal from sleep. To test the involvement of the locus coeruleus, mice were injected with a toxin (DSP4) to destroy its cells and exposed to CO₂ during sleep. It was found that DSP4-injected mice took longer to wake up to CO₂, supporting locus coeruleus involvement. This finding advances our understanding of the CO₂-induced arousal mechanism and may be important in the prevention of SUDEP and SIDS.

48. Rebecca Hauser

Major: Speech and Hearing Science

Mentor: Inyong Choi (Communication Sciences and Disorders)

Analyzing Auditory Evoked Potentials in Hybrid Cochlear Implant Listeners

Hearing loss is a problem experienced by many people in aging populations. Hearing aids provide acoustic assistance. Cochlear implants provide electric assistance, and are not implanted until hearing loss is significant, because electric processing differs from acoustic. A hybrid cochlear implant combines acoustic and electric sound elements which allows patients to be surgically implanted earlier, and therefore use their residual hearing to interpret or translate the new electrical sound information. This study focuses on patient progress, in terms of phoneme identification, of hybrid cochlear implant users. Evaluation is done through measuring cortical auditory evoked potentials. The differences noted between hybrid cochlear implant users and normal hearing users, in terms of auditory evoked potentials, were recorded through Electroencephalography, (EEG). EEG is the use of a neural cap and electrodes, which are used to visualize brainwaves. These brainwaves were later entered into a data analysis program, MatLab, and abnormal findings "artifacts" were removed for further study. The stimulus used to measure patient progress was the California Consonant Test, which produces one word in background noise meant to parallel the everyday auditory situations a hybrid cochlear implant user may face. The initial data collection was promising, and the data is being further analyzed.

50. Abby Haynes

Majors: Marketing, Economics

Mentor: Andrea Luangrath (Marketing)

Physical Mimicry of Visual Textual Paralanguage

The development of new communication channels, social media outlets, and text-based icons such as emojis has dramatically shifted the landscape of electronic text-based communication from that of simple punctuation like periods and exclamation points to that of "Woohooo" and "LOL." These expressions, now common to text communication, are known as forms of textual paralanguage (TPL), which serve as a surrogate for non-verbal cues in text.

This work explores whether people mimic the facial expressions conveyed by emojis, a specific form of textual paralanguage. We know that people unconsciously and automatically mimic the facial expressions of others when communicating via face-to-face, so does the same hold true for emojis in text-communication?

We conduct two studies exploring (1) whether there is a significant difference in the degree of joy/sadness expressed upon reading a text laden with a happy vs. sad emoji and (2) whether people mimic emojis to the same extent that they do human faces. The results of these studies do not allow us to conclusively answer our research question. Therefore, we seek to run additional studies that isolate potential instances of mimicry and use more advanced facial tracking technology such as facial EMG.

52. Brady Hoskins

Major: Computer Science

Mentor: Jacob Michaelson (Psychiatry)

Predicting Autism Spectrum Disorder (ASD) at Birth Using Machine Learning

The rates of autism spectrum disorder (ASD) diagnosis have grown rapidly over the past 10 years, most recently being detected in 1 out of 59 children. The process for individuals with ASD of receiving this diagnosis is often lengthy and challenging, requiring numerous health-care professionals. This has led to the need for a reliable way for doctors to expedite current clinical methods of diagnosis. Addressing this, the aim of this study is to develop a test capable of determining the likelihood of a newborn being diagnosed with ASD later in their childhood. To accomplish this, we have acquired a large newborn blood-test dataset. With this data we use machine learning techniques to predict future autism diagnoses. Moving forward, my analysis will include more advanced methods such as something called deep learning, which may show superior performance. This study is the first attempted diagnostic test of ASD at birth of its kind and will help advance data-driven alternatives to traditional methods of diagnosis.

54. Akpevweoghene Ikoba

Major: Human Physiology

Mentor: Melissa Bates (Health and Human Physiology)

Assessing the Autonomic Nervous System in Premature Infants

Thirty seven weeks of intrauterine development are needed for full maturation of the autonomic nervous system. The time course of autonomic nervous system development prior to birth is not well understood, and it is not known if there is a critical developmental window in which normal development can be disrupted. Our work aims to evaluate the autonomic nervous system in newborn premature infants through measuring heart rate variability. Premature infants were recruited from the University of Iowa NICU within seven days of birth and beat-by-beat heart rate was obtained from the EKG or central blood pressure tracing. Heart rate variability was analyzed through measuring different frequency domain parameters: Very Low Frequency (VLF), Low Frequency (LF), High Frequency (HF), and LF/HF Ratio. Preliminary results showed no major differences among frequency parameters across gestational ages. However, there was a small difference in the LF Frequency band among infants born before 37 weeks and infants born after 37 weeks. Infants born prior to 37 weeks had a LF Power of 17.49% and infants born after 37 weeks had an LF Power of 18.94%. Based on our current data, we conclude that there is no relationship between gestational age and autonomic tone at birth, but a larger sample size may be needed to make a strong conclusion about the impacts of prematurity on the autonomic nervous system.

56. Zain Khan

Majors: Computer Science and Engineering, Mathematics

Mentor: Bob Boynton (Political Science)

Character in the 2016 Presidential Election

Party, policy, and character have been key in presidential elections. Character has been the most difficult to assess. Many attempts have been made to assess views of the character of candidates. Previously, a program determined the individual referred to in a tweet, the character trait being used, and then employed a multi-level language gradation for assessing the sentiment of an individual. This approach is different. Word embeddings are utilized to examine the way the understanding of character changes as you move from one population to another. Word embeddings are a computationally sophisticated procedure to realize this phrase: "you shall know a word by the company it keeps." The behavioral words which are in the company of "Clinton" and "Trump" tell us how they are understood as persons and candidates. The data examined include Twitter streaming API searches for Clinton and Trump from June through November. These are parallel collections that include many million tweets. A subset of that collection includes accounts Twitter suspended by early in 2017 and the tweets connected with the Russian IRA are viewed closely. It is displayed how the articulation of character changes as you move from one population (e.g. Clinton or Trump supporters) to the next.

58. Nicole Khvalabov

Major: Speech and Hearing Science

Mentor: Jean Gordon (Communication Sciences and Disorders)

Listener Judgements of Fluency and Perceptions of People with Aphasia

Aphasia is a neurological disorder resulting from an injury to the brain that disrupts effective production or comprehension of language. Depending on the type and severity, aphasia may be classified as fluent or nonfluent. A person with aphasia (PwA) is categorized as fluent if they can produce connected speech smoothly with little effort, and if their sentence structure is mostly grammatical, although it may lack meaning. Fluency is thought to play an important role in how speakers are perceived; studies show that less fluent speakers, particularly people with aphasia, are perceived less favorably compared to their fluent peers. The aim of this study was to assess how listeners' perceptions of fluency affect their perceptions of the personality characteristics of PwA. This sort of bias is important, as it might influence the accuracy with which speech-language pathologists assess PwA. Seventy-six undergraduate students at the University of Iowa listened to speech samples from 24 PwA and rated the fluency and personality characteristics of each PwA. We are examining the relationship between fluency of language production and personality ratings. Implications will be discussed for social interactions between PwA and younger adults.

60. Keely Kinsella

Major: Anthropology

Mentor: Jon Doershuk (Office of the State Archaeologist)

Preservation of the John and Phil Palmquist Collection from Southwestern Iowa

In Fall 2018, John Palmquist, a longtime member of the Iowa Archeological Society, transferred care of his collection of archaeological artifacts into the hands of the Office of the State Archaeologist for inclusion in the State Archaeological Repository. The John and Phil Palmquist Collection, rare for most private collections, consists of well documented and responsibly collected artifacts acquired across southwestern Iowa over many years, and includes uncommon projectile point types as well as other rare artifacts. The diligence of the Palmquists in carefully and ethically collecting archaeological materials while preserving the scientific information associated with them will serve to enhance our understanding of southwestern Iowa's archaeological history. It also serves to illustrate an example of the merits of cultivating relationships between responsible avocational archaeologists and professionals. This presentation will summarize the findings of research in progress on the collection, as well as highlight future avenues of potential study.

62. Brianna Klabunde

Major: Philosophy

Mentor: Carrie Figdor (Philosophy)

Deafness and Disability: An Analysis of the Measurement of Well Being

Roslyn Rosen, a board member on the National Association of the Deaf and a deaf woman herself with a deaf family, is quoted as saying, "I don't want to be 'fixed'. In our society everyone agrees that whites have an easier time than blacks. But do you think a black person would undergo an operation to be white?" To most hearing individuals with limited to no interaction with the deaf community, the claim that deafness is a cultural difference rather than a disability may be shocking. However, this is exactly what members of the deaf community have been trying to make clear for many years. In this paper, I delve into the arguments and intuitions from both the medical and deaf communities to try and make sense of each perspective. Philosophical arguments on the issue indicate that a clear understanding of well being is essential to deciding what should count as a disability and what should not. So what exactly counts as a harm to one's well being from the perspective of the medical community? Are our intuitions about well being correct? Is deafness a harm?

64. Alexa Kort

Majors: Biochemistry, Spanish

Mentor: Hillel Haim (Microbiology and Immunology)

Volatility forecasting model to predict emergence of antibody escape variants in HIV-infected individuals

An estimated 21.7 million people with HIV-1 are treated with antiretroviral medications worldwide. The low-fidelity replication system of HIV-1 allows introduction of mutations into the viral genome. In some patients, initiation of treatment results in the emergence of resistant mutants that can escape neutralization by the therapeutic agent and antibodies. The occurrence of these events is random and therefore is considered unpredictable. The envelope glycoproteins (Envs) on the surface of the virus, which enable infection of the host cell, are attractive targets for therapeutics. We recently discovered that each amino acid position of Env exhibits a defined level of in-host variance or variability, which we designate volatility, that is conserved in different hosts. We hypothesized that future increases in volatility can be accurately predicted by the level of current and past volatility. For this purpose, we investigated the different properties of volatility and observed three clustering patterns: genetic, temporal, and spatial. We integrated these volatility patterns into a forecasting expression to predict future levels of volatility in each patient. We found that the model predicts well appearance of high-volatility states at key positions of Env that mediate escape from drug inhibitors and antibodies. This model could be applied to tailor therapeutics to patients based on the calculated likelihood for emergence of mutants resistant to each therapeutic agent.

66. Dariya Kozlova

Major: Biomedical Sciences

Mentor: Brandon Davies (Biochemistry)

Functional assessment of common human mutations in ANGPTL3

Cardiovascular disease is the leading cause of death in the U.S. Increased fat levels in the bloodstream are a risk factor for the development of cardiovascular disease. Lipoprotein lipase (LPL) and endothelial lipase (EL) are proteins that regulate the clearance of fat from the bloodstream. Their activity can be regulated by angiopoietin like protein 3 (ANGPTL3). Genetic loss of ANGPTL3 causes lower levels of fat and protection against cardiovascular disease. There are several known mutations in the ANGPTL3 gene associated with altered plasma fat levels. We aim to identify how these mutations alter ANGPTL3 actions on LPL and EL. Human ANGPTL3 gene mutants made include: G56V, K63T, M259T, F295L and R332Q. We found that human mutants F295L and R332Q do not produce ANGPTL3 protein. The mutants G56V, K63T and M259T were able to be expressed; however, showed no difference in EL inhibition compared to non-mutated protein. We plan to test LPL inhibition by these mutants and the ability of the mutant proteins to interact with ANGPTL3,

an important cofactor. Successful completion of this research will increase our understanding of the structure and function of ANGPTL3 and will improve our ability to target ANGPTL3 in therapies for cardiovascular disease.

68. Emily Laverty

Major: Neuroscience

Mentor: Rebecca Dodd (Internal Medicine)

Epigenetic Combination Therapy Improves Survival and Causes Tumor-Specific Immunomodulation in Soft Tissue Sarcoma

Approximately 15% of pediatric cancers are sarcomas, a diverse group of connective tissue tumors comprised of over 50 subtypes. The broad assortment of different types of sarcomas makes it challenging to understand and treat these tumors successfully. In order to find the most effective chemotherapy treatment, we are investigating a new combination therapy using low dose Decitabine (Dec), a DNA methyltransferase inhibitor, with Gemcitabine (Gem), a cytotoxic drug, for the treatment of soft-tissue sarcoma. Our data show that Dec/Gem combination treatment slows tumor growth more effectively than treatment with Dec or Gem alone. We have also found that tumors in mice treated with the Dec/Gem combination have increased levels of infiltration by the immune system, specifically by tumor-specific CD4 T cells. We hypothesize that Decitabine helps make Gemcitabine more effective at killing cancer cells by changing DNA methylation profiles, resulting in recruitment of anti-tumor immune cells. In addition to characterizing immune cell infiltration within the tumor, we are examining RNA profiles and cytokine production to better understand the mechanisms by which these drugs act.

70. Mary Li

Major: Neuroscience

Mentor: Azeez Butali (Oral Pathology, Radiology, and Medicine)

Association of Catenin Alpha-2 (CTNNA2) with Cleft Palate in Sub-Saharan African Populations

Cleft palate only (CPO) is a congenital birth defect where the palate fails to fuse properly during embryonic facial development. CPO affects 1/500-1000 live births world-wide and imposes significant social and financial burdens on affected individuals and their families. The etiology of CPO is complex and likely results from a combination of genetic mutations with environmental covariates (Moreno et al., 2004). A recent genome wide association study for orofacial clefting (OFC) in Africa identified a novel locus near protein coding gene, Catenin Alpha-2 (CTNNA2), which was shown to be associated with risk of CPO in African populations (Butali et al., 2018). We sequenced the CTNNA2 gene in African CPO samples in order to find mutations that may provide potential explanations for CPO's missing heritability.

One rare missense mutation was found: p.Ser853Gly. The mutation was previously reported but had not been validated before this study.

Bioinformatic analyses suggest high conservation of the wild-type residue. A

structural inspection suggests that the mutation from serine to glycine would disturb the rigidity and binding function of the protein. This study contributes evidence towards the suggestion that CTNNA2 mutations may contribute to risk of CPO in the African population.

72. Tianyi Li

Majors: Environmental Science
Mentor: Elizabeth Stone (Chemistry)

The sources of air pollution in Nepal

The invisible pollution in the air can be breathed in and cause multiple health problems, especially respiratory and cardiac problems. According to the World Health Organization (WHO), Nepal had the 7th highest air pollution in the world in 2016. In order to reduce air pollution, we should find out where the pollution is coming from. PM2.5 and PM10, which refers to atmospheric particulate matter (PM) that have a diameter of less than 2.5 and 10 micrometers, are two types of standards to measure air pollution levels. To find out the sources of fine particles in the air, we chemically analyze PM samples from Nepal. The organic compounds in PM can be used as different tracers to identify pollution sources. The objectives of our research are to 1) quantify the air quality levels in Nepal through the PM2.5 and PM10 mass and 2) identify the primary and secondary sources of air pollution by organic tracers. (major findings). These results can be used to identify the major sources of air pollution and help to find doable solutions to reduce air pollution.

74. Xinyi Li

Majors: Business Analytics and Information Systems, Finance
Mentor: Xun Zhou (Management Sciences)

Semantic Clustering of Spatial Regions for Urban Event Analysis

This research uses urban mobility data to analyze traffic conditions and understand human movement patterns during large events. We apply data mining methods and spatial computing techniques to facilitate traffic management and enhance urban intelligence. We cluster urban areas based on the similarity of their pick-up counts to find a meaningful grouping of locations.

76. Jiaming Lin

Majors: Finance, Mathematics
Mentor: Clare Wang (Accounting)

Going Concern Opinion and Bankruptcy Effect on Business Competitors

This research will explore the going concern opinion and bankruptcy effects on business competitors. The research will include two main points. The first one is to discover whether there is a positive or negative relationship between a company's announcement of bankruptcy and its competitors' stock prices.

After discovering a significant relationship, this paper will measure the predictability of a company's going concern standard auditor letter on business competitors' stock prices. When a company receives a going concern opinion on its financial statements, will its competitors react on this audit information through their stock prices? My findings show that there is a significant relationship between a company's going concern opinion and its competitors' stock prices.

78. Victoria Cassady

Major: Biochemistry, Microbiology

Mentor: Ronald Weigel

A Novel Gene Signature for Predicting HER2-enriched Breast Cancer Outcome is Revealed by RNA Sequencing

Breast cancer affects one in eight women in the U.S., resulting in over 42,000 deaths annually. HER2+ breast cancer is associated with worse prognosis and higher risks of recurrence and metastasis, which was previously showed to be regulated by transcription factor activation protein C (TFAP2C). However, the mechanism of TFAP2C in HER2+ breast cancer remains unclear. Here we identify differential gene targets of the transcription factor TFAP2C within the HER2+ subtype and propose a mechanism of regulation. By comparing cell growth and invasiveness through MTT and invasion assay in TFAP2C eliminated HER 2+ breast cancer cell lines we found that TFAP2C regulates CDH5 and CDKN1A, two genes highly associated with HER2+ breast cancer outcome. A detailed understanding of differential gene regulation within the HER2+ subtype is crucial for understanding the biology of HER2+ breast cancer and informing treatment development.

80. Olivia Lullmann

Major: Neuroscience

Mentor: Lyndsay Harshman (Pediatrics, Nephrology)

Anyone interested in Science

This research focus how children in the early stages of CKD often have lower neurocognitive functioning than their peers who do not. The research investigates where exactly kids with chronic kidney disease lack in neurocognitive functioning, such as executive functioning. It also investigates if there is any abnormalities or differences in the brain in children with early CKD.

82. Jack Lynn

Major: Chemical Engineering

Mentor: Gordon Buchanan (Neurology)

Sleep well – Should sleep deprivation be considered a risk factor for SUDEP?

Little is known about why sudden unexpected death in epilepsy (SUDEP) occurs despite it being the leading cause of epilepsy-related death. However, it is well-

documented that SUDEP is more likely to occur at night, indicating a possible connection between SUDEP and sleep. Conversely, the deprivation of sleep may also correlate to increased onset of SUDEP due to its effects on seizure severity and duration. Depriving mice of rapid eye movement sleep causes longer seizures with decreased thresholds, both of which are well-documented risk factors of SUDEP. This occurs because the turnover rate of brain monoamines which protect against seizure-induced death increases, leaving the body more vulnerable. Additionally, bodily functions, especially in cardiac and respiratory regions, operate more irregularly after sleep deprivation, increasing the amount of carbon dioxide in the blood and the brain. Increased carbon dioxide increases the respiratory drive to avoid seizure-induced respiratory arrest. The purpose of this experiment is to determine if depriving mice of one night of sleep will increase the risk of mortality after seizure-onset. Eight mice were either deprived of 12 hours of sleep or allowed normal sleep and then induced with maximal-electroshock seizures. Mortality, breathing, and brain function were all measured as outcome measures. This research is particularly important for epilepsy monitoring units, which regularly use sleep deprivation, and for general purposes.

84. Samantha Mackin

Major: Biochemistry

Mentor: Kris DeMali (Biochemistry)

Investigating Metabolic Changes in Response to Force on E-Cadherin

All cells experience a variety of physiological forces during their lifetimes. It is essential for these cells to have mechanisms of resistance in order for them to survive. Cadherins are proteins that initiate these mechanisms called cell stiffening, an energetically expensive process in which a cell reinforces its cytoskeleton and produces more ATP, the energy currency of cells. For such an energy-intensive process, cells require more glucose from their environment to use as energy. My project is interested in how epithelial cells are able to increase their glucose uptake in response to force. In epithelial cells, the primary cadherin is E-cadherin and it has been shown to accumulate on the cell's membrane in response to force. We have demonstrated that glucose is entering cells with the help of the glucose transporter protein, GLUT1, which accumulates at the cellular membrane in response to force. In cells with decreased expression of the GLUT1 protein, glucose uptake in response to force is significantly diminished. These cells also have a decreased ability to reinforce its cytoskeleton to resist physiological forces. Taken together, these data further define the link between cellular metabolism and cell stiffening.

86. Taylor Magnuson

Major: Psychology

Mentor: Paul Windschitl (Psychological and Brain Sciences)

Perspective Taking as a Method for Debiasing Overoptimism

Past research in social psychology has shown that biases impact everyday decision-making. Using two conditions, this experiment explored the optimism

bias in sports fans by measuring whether taking the perspective of the opposing team would reduce optimism for the home team in an upcoming football game. In one condition, participants gave their own likelihood judgement of their team winning and were then asked to make the same estimate from the opposing team's perspective before making an objective likelihood judgement. The other condition simply asked participants to give an objective likelihood judgement. Results showed that when participants were asked for an initial likelihood estimate from their own perspective, it was typically higher than when they were later asked for an objective estimate. In addition, participants gave higher likelihood judgements from their own perspective than from the perspective of the opposing team. Most importantly, results showed the condition in which participants were asked to consider the perspective of the other team favored their own team less heavily than the condition in which participants were not asked to consider the alternative perspective, supporting the idea that taking the perspective of the opposing team can reduce the optimism bias.

88. Xinyu Mai

Majors: Physics, Astronomy

Mentor: Shea Brown (Physics and Astronomy)

Classifying Radio Galaxies with the Convolutional Neural Network

Machine learning (ML) is used to develop algorithms that deduce complex patterns in large data sets and is becoming an in-demand tool in all fields of inquiry. Convolutional Neural Network (CNNs) is one variant of ML that has recently been explored in a number of astrophysical problems. We use a CNN to detect different classes of radio galaxies in the new Very Large Array All-sky Survey (VLASS). Radio galaxies are ordinary galaxies that emit energy in the form of radio waves due to gas falling into a supermassive black hole in their center. These radio galaxies can be used as tracers of the cosmic environment, detect invisible gas in the universe, and further address unresolved astronomical questions. Due to the size of these new surveys, the key benefit of applying this technique is to automatically detect and label stars, galaxies, and other types of objects in future sky surveys with high speed and accuracy. We construct our CNN in the Python programming environment and trained it using images identified by hand. Our algorithm is able to correctly classify radio galaxies over 70% of the time and can be used to search millions of images in a matter of minutes.

90. Abigail McKernan

Major: Human Physiology

Mentors: Barry London (Internal Medicine); Alexander Greiner (Internal Medicine)

Novel variant discovered in a family that cosegregates with premature ventricular contractions, cardiac fibrosis, bicuspid aortic valve, and sudden cardiac death

Sudden cardiac death (SCD) was responsible for over 350,000 deaths in 2016. SCD can occur from heart failure, heart attack, or irregular heart rhythms. Our lab identified a family with abnormal extra heartbeats, a scarred heart, and an abnormal heart valve. Clinical genetic testing failed to identify genetic mutations which could cause SCD. We sequenced all protein coding regions in 4 family members with this disease to identify a genetic variant which may cause this disease. We identified a variant in a protein, MSX1, which participates in the development of the heart. We hypothesized that MSX1 contributed to cardiac disease in this family and sought to understand the role of it in cardiac function. We generated a mouse that did not have MSX1 in the heart. Measurements of their cardiac electrical activity, function, and size were performed. We also measured the impact of Msx1 deletion on protein production within the heart. Our data suggests MSX1 may contribute to this family's disease. Mice lacking Msx1 demonstrated irregular heart rhythms and had larger hearts. Further studies are necessary to characterize this mechanism by which MSX1 contributes to cardiac disease in this family.

92. Cameron Moeller; Jiangchun Xu

Majors: History, International Relations; Anthropology, Mathematics

Mentor: James Enloe (Anthropology)

Picking up the Pieces: Analysis of Human Behavior Through Artifact Distribution

Though common perceptions of archaeology center on the excavation of artifacts in the field, this is just the first step in the process "" it is only through subsequent analysis that the meaning behind those artifacts can be understood. A primary component of this analysis focuses on the spatial distribution of artifacts, revealing the human behavior patterns which deposited them. The distribution of artifacts at Woodpecker Cave, a rock shelter located along the Coralville reservoir, was recorded using GIS (Geographic Information Systems), photography, and other methods, allowing distributions to be displayed through density maps. These maps, which have been refined to account for later disturbances, reveal several distinct habitation periods and behavior patterns, allowing us to determine when people were present at the site and what they used it for. Knowing how Woodpecker Cave was utilized allows us to understand its role in relation to other habitation sites in the area, recreating a larger picture of human behavior in the region.

94. Tengku Mohd

Major: Business Analytics

Mentor: Wayne Jacobson (Office of the Provost)

Text Mining on Students Experience in the Research University Survey

Every year the University of Iowa sends out the Students Experience in the Research University (SERU) Survey. SERU provides an extensive overview of the

student experience, gathering information on academic and community engagement, experiences in the students' major, overall satisfaction, and perceived campus climate for diversity. Text mining is the process of examining textual data to generate new information and to transform the unstructured text into structured data for use in further analysis. Text mining was used on the SERU survey to identify any important facts, relationships, and assertions in answers to the survey. This extracted information can then be evaluated to determine whether changes can be implemented to improve students' education experience.

96. Hailey Moore

Majors: Astronomy, Physics

Mentor: Cornelia Lang (Physics and Astronomy)

The Galactic Center Radio Arc: Understanding the Polarization Properties and Intrinsic Magnetic Field

In the center of our galaxy lies a series of linear filaments that are visible to radio observatories. We have observed one particular set of filaments known as the Radio Arc in two separate frequency bands using the Very Large Array radio telescope in New Mexico. These filaments are powered by synchrotron radiation and likely signify the structure of the magnetic field in the Galactic Center. This magnetic field can tell us about the transport of energy out of the center of the Galaxy. We analyze the magnetic component of the Galactic Center to learn about the structure of the magnetic field as a whole. The presence of polarized intensity along these filaments helps to reveal the structure of the magnetic field. We observe an uneven, or patchy, distribution of polarization and use this to understand the properties of the polarization. We use the polarization properties to learn about the intrinsic magnetic field of the Radio Arc. Finally, we look to see where a possible external "'helical structure' could be interacting with the linear filaments and affecting their properties.

98. Pooja Patel

Major: Biomedical Sciences

Mentor: Lori Adams (Biology, Latham Science Engagement Initiative)

Showcasing Pathogenic Viruses through the use of Art

This project entails creating pictorial representations of viruses that cause human disease and increasing the awareness of these pathogens/their mechanisms of action through the use of this art. The viruses that are displayed as a part of the project include: Human Immunodeficiency Virus (HIV), Ebola virus, Influenza, Zika virus, Hantavirus, Dengue virus, Bacteriophage that causes Cholera, Rabies virus, Hepatitis A/B/C virus, and Human Papilloma Virus (HPV). These viruses all impact humans around the world, therefore they are easy to relate to. Understanding more about these pathogens will increase awareness of their mechanisms of action and the

diseases they cause. Each of the virus images includes a QR code that links to the project's Stem-O-Sphere blog. This blog has more information regarding the virus, the parts of the virus, and its implications on human health/how it causes disease. Images of the viruses are also portrayed on Stem-O-Sphere's Instagram page! Overall, the aim of this project is to enable people to understand the importance of these viruses and their pathology through the use of art.

100. Marissa Mueller

Major: Biomedical Engineering

Mentor: Laura Frey-Law (Physical Therapy and Rehabilitation Sciences)

Comparing Methods of Quantifying Physical Activity using Actimetry

Actimetry is the study of objectively measuring of physical activity (PA), being used increasingly for clinical and recreational purposes. Prescribed activity has emerged as a new frontier in preventative and rehabilitative medicine, where devices called accelerometers sense motion at the wrist/hip. While products like the Nike Fuel Band and Fitbit serve the general population, researchers rely on clinical-grade accelerometers (ActiGraph-GT3X) and software platforms (such as ActiLife) to convert raw accelerations to useful measures of daily steps, energy expenditure (EE) and time spent in moderate-to-vigorous activity (MVPA) for clinical analyses. Despite technological advances, a lack of standardization in this conversion process remains problematic; the cumulative effect of algorithms and filters may not be well understood. Thus, the purpose of this study was to quantify how select analysis methods influence PA metrics. Data from 134 participants wearing an ActiGraph GT3X Accelerometer on the wrist for one week was evaluated using ten different equations, a wrist correction and a frequency filter. Large variations in PA estimates between methods were observed for EE ($\leq 83\%$), MVPA ($\leq 100\%$), and steps ($\leq 40\%$). Although the methods examined were previously validated, they are not interchangeable, indicating that exact measures of PA are highly dependent on employed analysis specifications.

102. Zachary Nelson

Majors: Informatics, Art

Mentor: Kyle Rector (Computer Science)

Road Safety Studies in Virtual Reality

Through the Hank Virtual Environments Lab at the University of Iowa, I am programming and modeling to create interactive environments in virtual reality to be used in psychological research relating to road safety for cyclists and pedestrians. This has included involvement in a bike simulation comparing protection to cyclists as a car turns to the right in front of the cyclist on guarded and unguarded intersections. Another study was seeing how elders may respond to an alert that notifies them of when it is safe to cross an intersection.

104. Kierra Pauly

Major: Anthropology

Mentor: James Enloe (Anthropology)

Recent Intrusions into Prehistoric Archaeological Sites: Historical Artifact Analysis

Woodpecker Cave is a prehistoric site occupied one thousand years ago for seasonal hunting along the Iowa River Basin. Recent archaeological excavations have uncovered historical material indicating the intrusion or occupancy by later individuals. Through examining the historical assemblage from this multi-component site, I have been able to establish site-wide trends and identify unique artifacts.

106. Bella Phillips

Major: Interdisciplinary Studies

Mentor: Jon Houtman (Microbiology and Immunology)

The Effects of Glycerol Monolaurate on Human B Cell Activation

Glycerol monolaurate (GML) is a compound found in numerous common household items and is present naturally in milk fat and coconut oil. GML is known for its ability to prevent bacterial and viral growth, however, our laboratory has also found that it also suppresses one's immune system. Earlier studies from our laboratory found that GML stops the activation of human T cells, which actively fight any foreign microbe that one encounters. This research focused on how GML impacts another common immune cell, B cells, which make antibodies needed to fight off infections. We found that GML also reduces the activation of B cells, similar to its effects on T cells. Together, our research shows that along with its ability to stop bacteria and viruses, GML can also suppress the immune system. This shows that GML could also potentially be used as a drug to stop overactive immune responses that occur in many diseases.

108. Marija Pritchard

Majors: Religion Studies, Biology

Mentor: Jenna Supp-Montgomerie (Religious Studies, Communication Studies)

The Connective Power Religious Minorities Attributed to the Telegraph

The telegraph was a revolutionary technology that changed how people conducted business and related to one another. It also had unintended effects on everyday people living all over the United States. Originally, the telegraph was meant for governmental and business transactions. It was not designed to be used for social or religious purposes, yet it captured the attention of various religious minorities in the United States. The Jewish community, the Mormon Community, and the Oneida community in particular were infatuated by the telegraph and the possible impacts it might have on them. The importance of the telegraph to each of these communities respectively is evident in their published newspapers articles of the time. All of these communities saw the telegraph as an almost divine tool that could be used to promote connection and unification in

the world and their own communities. The importance and celebration of the telegraph in these communities gives us new insight to how the telegraph and religion influenced to promote connection.

110. Pravda Quinones

Major: Human Physiology

Mentor: Barry London (Internal Medicine)

The Effects of Vitamin B3 Supplementation on Cardiac Electrical Activity Within a Living Organism

Vitamin B3 supplementation has emerged as a strategy for the prevention and treatment of cardiovascular diseases. Recently, our group has shown on a cellular level that the bioavailable vitamin B3 derivative Nicotinamide Riboside can modulate electrical currents that aid in coordinating the heart's contraction. However, the effect of Nicotinamide Riboside on electrical activity within living organisms has never thoroughly been explored. The purpose of this project was to examine the effects of dietary supplementation of Nicotinamide Riboside on electrical activity in normal mice. Compared to mice that were fed a regular diet, mice fed a diet with NR had no difference in body weight, suggesting the diet was tolerated. Interestingly, mice fed Nicotinamide Riboside had changes in their electrocardiogram (EKG) parameters that were reflective of the changes in electrical currents that we observed on a cellular level. This is the first time that alterations in electrical activity have been reported with dietary Nicotinamide Riboside within a living organism. These changes in the electrical currents and the EKG parameters warrant the consideration of Nicotinamide Riboside as a novel therapy for the treatment of electrical disturbances in heart, known as arrhythmias.

112. Theo Romac

Major: Biomedical Engineering

Mentor: E. Dale Abel (Internal Medicine)

Increased Autophagy and Heart Failure Due to Transcription Factor EB (TFEB) Over Expression

Autophagy is a cellular process that recycles and eliminates waste from the cell. When this process is impaired, it can lead to numerous cardiovascular defects, possibly even total heart failure. Lysosomes play an important role in autophagy. Transcription factor EB (TFEB) is very important in the regulation of autophagy and signals to genes to make more lysosomes. The purpose of this study was to determine if TFEB overexpression in the heart would increase autophagy and lead to heart failure. To study this, a mouse model was used to study the role of TFEB in the heart. Mice with TFEB overexpression had worse heart function than mice with normal TFEB levels. They also had an increase in autophagy proteins and RNA. mTOR signaling was also elevated, which is traditionally known to inhibit autophagy. TFEB overexpression in the heart resulted in an increase in autophagy and cardiac dysfunction.

114. Tyler Roth; Jillian Schenck

Majors: Physics, Astronomy; Physics, Astronomy, Philosophy

Mentor: Robert Mutel (Physics and Astronomy)

Gemini Supernovae Light Curves: Interpreting Double-Humps and Einstein Lens Events

116. Sydney Schreiber

Major: Philosophy

Mentors: Carrie Figdor (Philosophy), Andres Carlstein (Health and Human Physiology)

Friend or Food: How Animal Mindedness Impacts Our Meat-Eating Decisions

As Americans, we see dogs as "man's best friend" and pigs as food. However, should there be much of a difference between how we perceive the two animals? The comparison of dogs and pigs seems relatively taboo in the United States, given how different the roles these two species play in our everyday lives. However, when we think about their cognitive capabilities, dogs and pigs are not so different. They are similarly intelligent and both have consciousness, just like humans. Based on this knowledge, we could make a case for pigs and other animals that their cognitive functions outweigh the benefits of them being food. What this paper will focus on is whether or not cognition or mindedness should play a larger factor when we ask ourselves if we should eat meat.

118. Cassandra Sheridan

Major: Neuroscience

Mentors: Ed Wasserman (Psychological and Brain Sciences), Leyre Castro (Psychological and Brain Sciences)

Selective and Distributed Attention in Pigeons

Categorization is the process by which one can recognize and classify objects in their surroundings. Objects may contain two types of features: one (or more) that is always present and, if you focus attention on it, allows you to solve a categorization task, and others that are more or less likely to be present so they are not so useful in solving a task. Here, we aimed to see if pigeons' attention could focus on a single feature (as adults do) or if their attention tends to be more diffuse (as in young children), depending on prior experience. Three groups of pigeons were pretrained with category exemplars containing either one single predicting feature, or six features that were only likely to predict the correct category, or both types of features. These differences in pretraining had an impact on pigeon's later performance. Pigeon's trained with the single feature first were more likely to use this feature with novel stimuli, whereas those trained with the six likely features were more likely to use these with novel stimuli. These results are

similar to those found in children and adults, and help us understand the evolution and development of attention in category learning.

120. Cassidy Shubatt

Majors: Economics, Mathematics

Mentor: John Solow (Economics)

TV Media Coverage and Voter Turnout

When purchasing television advertising, it can be difficult to target your ideal audience. This becomes apparent every election season "" if you watched any television in Iowa City this past fall, you almost certainly saw advertisements for Abby Finkenauer and Rod Blum, neither of whom appeared on the ballots of Iowa City voters. However, Iowa City falls in the same Designated Marketing Area (DMA) as Cedar Rapids, Waterloo, and Dubuque, all of which fall in the first congressional district where Finkenauer and Blum were running. Because the campaigns don't get to choose exactly where their advertisements air, there is some pseudo-random variation in how much election coverage voters are exposed to through their televisions. I exploited this by looking at voters who fell in the same congressional districts but different media markets, and estimated the effect of election coverage levels on a registered voter's probability of voting. I found a significant positive effect equal to 4.7 percentage points of voter turnout. I discuss how advertising and news coverage itself may contribute to this effect and propose suggestions for other research questions that could utilize the mismatching of DMA and congressional borders.

122. Britney Spack

Major: Human Physiology, Psychology

Mentor: Terry Wahls (Internal Medicine)

Differences in Participant Burden for Individuals Randomized to a Paleolithic Diet Compared to a Mediterranean Diet

The purpose of this study was to assess the differences in research participant burden between individuals who were randomized to either the Wahls Elimination diet or the Swank diet. Participants were individuals who are currently participating in a comparison of the two dietary interventions investigating the effects on of MS-related fatigue. All participants were diagnosed with RRMS and randomized to one of the two diets. This was a cross-sectional analysis of participants at visits 1, 2, 3, and 4. A survey was completed by participants and the time for diet-related assessments at study visits was recorded by the study team. The goal was to investigate the level of participant burden and perceived difficulty of complying to each diet. The components of the survey included time during study visit, rating the difficulty of complying to the diet, level of difficulty and amount of time to complete the food record, level of hunger throughout the day, fullness following a meal, and palatability of the food. Results will be assessed upon the completion of the study. Future studies should assess these differences over the course of the 36-week intervention.

124. Emma Thayer

Major: Human Physiology

Mentor: Kim Brogden (Iowa Institute for Oral Health Research)

A Model to Assess Microbial Killing in Tooth Root Canals

Introduction: Root canal therapies require chemical and mechanical debridement to reduce infection and inflammation, but there is often reinfection after treatment. Here, I assessed the ability of a 265 nm light emitting diode (LED) to kill four types of bacteria, *E. faecalis*, *C. albicans*, *S. aureus*, and MRSA #7, all of which persist in infected tooth roots. Methods: A model was developed where each type of bacteria was put into two extracted, sterile tooth roots. One tooth had water added to it, which served as the control, and the other tooth had the 265 nm LED shone into it. Each tooth was rinsed and put in spots on blood agar plates. At 24 hours, bacterial colonies in each spot were counted. Results: *E. faecalis*, *C. albicans*, *S. aureus*, and MRSA #7 all remained alive in water and had an average of 37.5, 9.0, 151.3, and 139.3 colonies. The treatments with 265 nm LED produced significantly fewer colonies with averages of 4.2, 1.8, 4.0, and 0. Conclusion: The 265 nm LED light used inside the tooth model is able to significantly kill many resistant bacteria and results indicate that it could be used as an addition to current root canal procedures.

126. Jacob Tinker

Major: Exercise Science

Mentor: Terry Wahls (Internal Medicine)

Nutritional Information from Visit 1 Dietary Data in the Dietary Approaches to Treating MS Related Fatigue study

Relapsing remitting multiple sclerosis (RRMS) is a form of MS in which an individual experiences consistent symptom flare-ups or relapses. The Dietary Approaches to Treating MS Related Fatigue study aims to treat symptoms of RRMS through dietary intervention. Subjects are randomly assigned to either the Wahls diet which consists of a dairy-free, no wheat, no grain, no egg diet that is rich in vegetables, or the Swank diet which focuses on a small intake of saturated fats per day. Each study participant completes four visits in 12-week intervals in which they give blood samples and are tested for various motor functions and eye measurements and complete a food frequency questionnaire and three-day weighed food record. The participants eat their usual diet for the first 12 weeks and are then randomized to one of the study diets for their remaining 24 weeks. We think that the Wahls diet group will show greater improvements in motor functions and fatigue levels though this data cannot be analyzed until the completion of the study. The mean, standard deviation, and range will be reported on dietary assessment data obtained from the participants visit 1 three-day food records.

128. Zach Vig

Majors: Physics, Geoscience

Mentor: Steven Spangler (Physics and Astronomy)

How Does The Standard Solar Cycle Vary?

When most people think of the Solar Cycle, they understand that there is an 11 year period during which the sun fluctuates in both brightness and activity. This 11 year period, however, is not the full story. Even though we see a repetitive, short-term, change, there is a significant long-term change that occurs in the individual short-term cycles. We are using solar flux data that has been gathered by the Canadian National Research Council since 1947 to investigate how exactly this cycle changes over time. Currently, we are in the process of analyzing various statistical figures with a final goal of seeing an overall trend in solar cycle variation. By comparing our findings with those of other researchers, we hope to find evidence that will either backup previous research about the solar cycle, or bring to light inconsistencies about what we take for granted involving how our star changes over time.

130. Henry Wang

Major: Neuroscience

Mentors: Kamal Rahmouni (Pharmacology), Deng Guo (Pharmacology)

MC4R Protein Role in Animal Metabolism and Blood Pressure

The receptor (MC4R) plays an important role in the control of food intake and energy expenditure by increasing nerve activity (SNA). In addition, brain activation of SNA promotes cardiovascular organs such as the kidneys to increase blood pressure. The receptor protein MRAP2 regulates the activity of MC4R, but its role in MC4R-containing neurons in the brain is not clear. We hypothesized that MRAP2 in MC4R neurons is essential for the regulation of energy and blood pressure. We generated mice that lack MRAP2 in MC4R neurons to test the importance of the MC4R receptor in homeostasis regulation. The MC4R lacking mice showed obesity as compared to the controls. Glucose and insulin tolerance tests revealed impaired glucose tolerance and insulin-induced glucose clearance in MC4R lacking mice compared to controls. Normal brown mice tended to be lower in MC4R mice relative to controls. Such findings support a role for MRAP2 in MC4R-mediated control of the brain impacting energy metabolism versus blood pressure.

132. Yihang Wang

Majors: Economics, Mathematics

Mentors: HyeongOTak Lee (Marketing), John Solow (Economics)

The influence of cultural distance on cultural communication in different countries and The impact of cultural transmission on export trade

The degree of acceptance and influence of foreign cultures in different countries is different. Taking today's popular music as an example, Western

popular music has not encountered many obstacles in entering Asian countries, but to the popular music from Eastern countries, it is difficult to be popular in Western countries. On the one hand, the level and time of development in popular music may be one reason, and on the other hand, at a deeper level in culture, cultural differences has significant influence on the cultural communication. Thus, one purpose of this project is to look for relationship between different Hofstede cultural dimensions and the transmission of popular culture. I'll mainly focus on the transmission of Korean popular music, and it is an appropriate research object since K-pop starts to raise in the world in the recent years. Furthermore, to a certain extent, consuming behavior, especially for young people, is affected by their preferences. I also wonder whether the popular cultural transmission among countries could affect people's consuming preferences, further influencing export trade.

134. Olivia Westemeier

Major: Psychology

Mentor: Teresa Treat (Psychological and Brain Sciences)

Sexually Aggressive Behavior and Risky Sexual Behavior: Protective Strategies

Male-initiated sexual aggression towards females is a serious problem on college campuses, and existing prevention programs are inadequate. The current work develops two measures of protective behavioral strategies (PBSes) that men might use to reduce sexually aggressive behavior and risky sexual behavior (e.g., avoiding sexual behavior when your potential partner is too intoxicated to provide consent, using protection against pregnancy). 440 undergraduate males reported how often they used each PBS in the last year on both measures, and they also completed a measure assessing endorsement of rape-supportive attitudes. At least a quarter of the sample reported often or always using each PBS, and at least 10% reported never or seldom using half of the PBSes. Additionally, those who endorsed more rape-supportive attitudes were less likely to report using PBSes to reduce sexual aggression. Incorporating review of PBSes for sexual aggression and risky sexual behavior might prove helpful for prevention purposes. Future work will (a) develop new items for both measures; and (b) obtain feedback from college men on the wording and appropriateness of items.

136. Alexis Williams

Majors: Evolutionary Biology, Anthropology

Mentor: Robert Franciscus (Anthropology)

Nasofacial skeletal differentiation among Equatorial Africans, Europeans and African-Americans

Biological anthropologists have long highlighted differences in the nasofacial region between African and African-derived populations, compared to European populations "" an observational interest driven by U.S. centered forensic applications, and research focused on nasal climatic adaptation. A

tendency in these studies has been to use African-American skeletal samples as proxies for Equatorial Africans. There is, however, abundant historical and genetic evidence to document that African-Americans reflect varying levels of European genetic admixture over the past 400 years. Here, we evaluate the extent to which European admixture (and possible genetic drift) in African-Americans has resulted in nasofacial divergence from the ancestral Equatorial African morphology. We used 18 nasofacial measurements collected on Equatorial Western African crania, and on Western Europeans and Central Europeans to create validated discriminant function (DF) predictive equations. We collected identical measurements on African-American crania and used the Equatorial African vs. European DF equations to predict into which group individuals in the African-American samples were assigned. The number of African-Americans classified as European averaged between 26.2% - 29.92%. Interestingly, these values are quite similar to the average estimates of European genetic admixture in African-Americans from recent genomic analyses.

138. David Wu

Major: Electrical Engineering

Mentor: Anton Kruger (Electrical and Computer Engineering)

Bat Recording Interface for Analyzing Wind Turbine Interaction

Wind energy's possible negative environmental impacts have yet to be examined closely. Specifically, there is limited knowledge of the adverse effects and prevention of bat fatalities around wind turbine sites. We developed a system that autonomously captures infrared video data of turbine sites to track bat interaction and collision. This data is combined with physical modeling and video analysis to accurately predict the outcome of a bat-turbine impact and develop deterrents to avoid bat fatalities. We deployed 16 systems in collaboration with MidAmerican Energy on August 12, 2018 to reliably capture the data required to analyze bat behavior.

140. Shao Yang Zhang

Major: Biomedical Engineering

Mentor: Justin Grobe (Pharmacology)

Increased vasopressin secretion during preeclampsia despite normal plasma osmolality

Preeclampsia (PE) is a condition that affects 4-7% of pregnancies worldwide with symptoms including high blood pressure and renal damage. Currently PE is only diagnosed in late pregnancy, and the only definitive treatment is delivery. Our group recently discovered that elevated plasma copeptin (CPP, a stable biomarker for arginine vasopressin, AVP) in early pregnancy predicts PE onset. Thus, the aim of this project was to understand the cause of elevated AVP during PE. We hypothesized that plasma AVP itself is elevated in early gestation of pregnancies that later develop PE due to altered volume regulation. Blood samples from early pregnancy were collected from pregnant women receiving prenatal care at the University of Iowa Hospitals & Clinics.

We determined that plasma AVP levels increased in women who later developed PE without changes in osmolality, which is normally the primary driver of AVP release. These data support the conclusion that maternal plasma AVP levels (in addition to CPP) are indeed increased in pregnancies that later develop PE, and this is due to mechanisms other than osmolality. Ongoing studies are exploring such alternative mechanisms, including reduced plasma volume and hormonal regulators of AVP secretion.

142. Elly Hofmaier

Major: Marketing

Mentor: Alice Wang (Marketing)

Effectiveness of Model/Mannequin Size for Willingness to Try and Willingness to Pay

Across two studies, size 16 female models and mannequins elicited better willingness to try scores in a randomized survey than size 4 models and mannequins. Paradoxically, size 4 models consistently provoked a greater average willingness to pay among participants. I pose that this discrepancy occurs due to hypothetical bias and universal expectations of luxury brands. Considering the results of the experiment, retail managers may find greater marketing success with the use of average size clothing displays (either models or mannequins).

