



**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

Mathematical modeling represents complex systems in a precise and concise way and can highlight the interesting aspects. Using a system of ordinary differential equations, which is a collection of equations that describe how fast or slow a quantity is changing in a given time frame, we can track the quantities of interest over time. In this case, we track the fluctuations of different bacterial populations in the human gut and the nutrients necessary for their survival over time. The mass of these bacterial populations depends on a number of factors, such as how fast they are flushed out of the gut, competition with other bacteria for resources, and how fast they grow. All of these factors are accounted for in the equations of the mathematical model. As we become increasingly aware that the bacteria in the gut impacts on person's overall health, it becomes increasingly important to understand the mechanisms behind their interactions.

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 potentiostat and electrodes due to an electrical waveform generated and transferred through a potentiostat from the external power-source. Powering the system wirelessly would remove the wired connection between the electrodes and instrument, minimizing the consequent noise. Modern potentiostats 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. Frequencies used for this set up are the same used in everyday remote controls. The system currently under development is a barebones potentiostat capable of performing triangular waveforms that are required for cyclic voltammetry and linear sweep voltammetry. The next stage of development is to power the device using radio waves and the final stage of development is utilizing the barebones potentiostat to work with wireless electrodes.

5. Barbara Badovinac

Major: Microbiology

Mentor: Lilliana Radoshevich (Microbiology and Immunology)

Determining the role of ISGylation of Rab7A during Listeria monocytogenes infection

ISG15 is an interferon-stimulated, ubiquitin-like protein, with anti-viral activity, however its role during bacterial infection had not been addressed. We previously found that ISG15 restricts Listeria infection both in vitro and in vivo and identified ISGylated proteins that could be responsible for the protective effect. More recently, we mapped the in vivo ISGylome following Listeria infection to mechanistically understand the function of this pathway in host defense. To do so we combined a genetic approach employing a murine model of hyper-ISGylation with quantitative proteomics of immune-enriched endogenous ISG15 modification sites. Interestingly, we detected ISG15 sites in several upstream modulators of the cellular starvation response called autophagy. This project is focused on one of these targets, the Rab7a protein. To learn more about the effects of ISG15 modification of Rab7a, we generated a wild type Rab7a and a non-conjugatable lysine to arginine mutant. Rab7a downregulation resembles the recessive genetic condition, Chediak-Higashi syndrome, which is characterized by the decrease of phagocytosis leading to many other complications, including reoccurring infections. Preliminary data shows possible differences in localization of Rab7a during ISGylation, indicating a trafficking phenotype. This work will open the door to understanding mechanisms of action of an understudied ubiquitin-like protein.

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

Previous work has shown that word learning in reading is more persistent over time when a training set is organized such that adjacent words have overlapping letters in their digraph vowels (for example, mean and bail overlap with a.) These results may support a schema based learning approach, as information that is consistent with previously learned schema is learned more rapidly than inconsistent information. However, computational models of reading present new challenges to schema based learning. The current research addresses two main questions. Firstly, rapid learning in a schema driven account has only been shown when the output of a novel stimulus is consistent within a previously developed schema. However, some behavioral data of learning to read show a benefit in retention when there is overlap in the input (in this case, the spelling of the vowel sound.) Can overlap in the input (rather than the output) increase the speed and retention of learning as well? Secondly, will these consistency/overlap effects persist in a domain with many-to-many mappings, as is the case in reading? We construct a neural network model to explicitly evaluate claims of schema based learning in reading.

11. Casey Blaylock

Major: Biomedical Engineering

Mentor: Jess Goetz (Orthopedics)

Spring Ligament Reconstruction using Different Configurations of Fiber Tape Changes Midfoot Bone Rotations During an External Rotation Stress Maneuver

Flatfoot (planovalgus) deformity is caused by weakness in the spring ligament which connects the navicular and the calcaneus and establishes the arch of the foot. Surgical correction of flatfoot deformity can be performed by repairing the spring ligament, though the optimal method of repair has not been established. In this work, two cadaveric ankle specimens were mechanically loaded with a 750N axial load and an 8.5 Nm internal tibial torque while the specimen was intact, after a flatfoot deformity was created by transection of the spring ligament, and after several different configurations of repair of the injured spring ligament using Fiber Tape. Movement of the individual midfoot bones was tracked by recording

reflective markers rigidly affixed to each bone using four infrared cameras. Bony kinematics were calculated by aligning marker positions from a CT scan to the positions recorded by the cameras and calculating the rotations of each bone in the sagittal, coronal, and transverse planes. As the number of bands of fixation connecting the navicular to the calcaneus increased, axial rotation of the navicular decreased, but when the navicular was fixed to both the tibia and the calcaneus, the axial rotation of the navicular increased with the tibia.

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 create a stable crystal structure. We analyzed the molecule looking for potential hydrogen bond donors and acceptors. Using the Cambridge Crystallographic software for cocrystal formation, we were able to determine the molecules that could form a novel solid forms by molecular complementarity and carried out a preliminary screening in the lab. 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)

Characterization of c-di-GMP Binding Proteins in Vibrio parahaemolyticus

To survive, bacteria must rapidly sense and respond to dynamic environments. One strategy bacteria employ is environment-dependent synthesis and degradation of second messenger molecules. One such molecule, c-di-GMP, influences global responses through affecting transcription, translation, and protein-protein interactions. Binding of c-di-GMP to PilZ domains alters behaviors including swimming, swarming, and biofilm formation. The marine bacterium and human pathogen *Vibrio parahaemolyticus* is predicted to have five PilZ-domain-containing proteins, PlzA-E. Here we provide initial characterization of PlzA-E in *V. parahaemolyticus* using gene overexpression and deletion in strains with low and high c-di-GMP. We analyze the importance of these proteins in motility and biofilm production. The activity of these PilZ-domain-containing proteins may expand the environmental colonization strategies of *V. parahaemolyticus*. Understanding these strategies 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)

Molecularly enhanced progesterone therapy in endometrial cancer

Endometrial cancer, the most common gynecologic 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. However, progesterone receptor (PR) expression is often reduced or lost in malignant tumors, which correlates with worse clinical outcome. Our group has systematically studied the mechanisms contributing to low PR expression in endometrial cancers, most notably, epigenetic silencing of PR transcription. We found that epigenetic modulation with histone deacetylase inhibitors (HDACi) have the ability to restore functional PR expression. Furthermore, the

combination of progesterone and epigenetic modulators can sensitize endometrial cancer to progesterone therapy in both in vitro and in vivo endometrial cancer models. Our group termed this as “molecularly enhanced progesterone therapy.” This strategy may reverse PR silencing and amplify the differentiating effects of progesterone in endometrial cancer cells. In addition, we confirmed that progestin +HDACi can reverse PR downregulation mechanisms by using tissue chromatin-immunoprecipitation (ChIP). Potential drug efficacy markers, such as CD52, DLK1, GNG2, GALNT9 and SPOCK1, were identified by transcriptome analysis. These studies have led to the approval of a new NIH NCTN trial, NRG-GY01.

21. Melissa Carlson

Major: Dance

Mentor: Martine Dunnwald (Anatomy and Cell Biology)

Mafb is not required for palatogenesis in mice

Cleft Lip and/or Palate (CL/P) is a facial abnormality found in children that impairs every day functions like eating and talking. Genome association studies found genetic variants in the transcription factor, MAFB, as being associated with CL/P. However, little is known about the role of MAFB in palatogenesis and its impact on CL/P. We hypothesized that MAFB is required for palatogenesis in mice and deletion (*Mafb*^{del}) or mutations (*Mafb*^{H131Q}) will contribute to CL/P. To test our hypothesis, we used wild type, heterozygous, and homozygous animals for both alleles. Embryos were harvested at embryonic day 14.5 and 18.5, and heads were processed for histological analysis. Following coronal serial sectioning, palatal shelf closure was evaluated and epithelial adhesions were measured. At e18.5, all the animals exhibited complete palatogenesis regardless of their genotype. At e14.5, a few epithelial adhesions were observed, but the percentage of epithelium in contact was not statistically significant between groups. This data suggests that MAFB is not required for palatogenesis in mice.

23. Haoxuan Chen

Major: Speech and Hearing Science

Mentor: Jean Gordon (Communication Sciences and Disorders)

Using verbal fluency to identify Alzheimer's disease

Word retrieval difficulty is one of the early signs of Alzheimer's disease, although such difficulties can also occur in typical aging. Therefore, it is necessary to find a task that differentiates the early stages of Alzheimer's disease from typical aging. Verbal fluency is a widely used measure to assess subjects' cognitive processes following neurological damage, and often includes two subtests: semantic fluency, in which participants are asked to produce words which have meet a semantic criterion, such as food or animals; and letter fluency, which requires participants to produce words starting with a certain letter, such as F or S. People with Alzheimer's disease have more difficulty with semantic than letter fluency, although this pattern

has also been shown in typical aging. In the current research, we investigate whether the semantic-letter discrepancy can 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

Semantic learning requires the ability to: retain and use the name of the pseudowords, remember the features of them, and rapidly and accurately recall other words within the same category. To examine how adults accomplish semantic learning and how it interacts with motor learning, we

developed a semantic learning paradigm in which participants are exposed to nonwords along with their physical and contextual features. 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: Locomotion Style Influences Behavior

Lemuriforms display an impressive range of adaptations, extending to unique forms of locomotion. Propithecus coquereli moves via vertical clinging and leaping. Other lemurs such as Lemur catta primarily locomote via quadrupedalism, but also employ a host of other movements. These interspecific locomotive differences contribute different energetic costs. To better understand the relationship between locomotive behavior and energetic cost between species, I gathered on locomotive behaviors and frequency for six species of lemurs, spanning 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)

Development and analysis of the viable impaction method for dry powder antibiotic aerosols on Pseudomonas aeruginosa bacteria

Pulmonary bacterial infections are often difficult to eradicate through intravenous or oral administration of antibiotics due to the presence of bacterial biofilms and the difficulty in achieving the desired drug concentration at the site of infection. These biofilms consist of bacterial colonies surrounded by a polysaccharide matrix that protects the embedded bacteria from external threats. Our lab is developing combination therapies to increase the susceptibility of bacteria to antibiotics. These drugs developed consist of an antibiotic and a nutrient dispersion compound to increase the susceptibility of the biofilm bacteria to antibiotics. The nutrient dispersion compound act as a bacterial nutrient and entice the bacteria out of biofilms, resulting in greater exposure to antibiotics. The objective of this

study is to develop a method for impaction of dry powder antibiotic aerosols on *Pseudomonas aeruginosa* bacteria. This involves combining aerosol technology with inhibition studies to analyze the bacterial susceptibility to the drug in a pseudo-lung environment. The antibiotic powders used in this study were generated using a spray dryer. 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 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. Current separation processes including hydrodesulfuration and membrane separation are expensive, and the development of alternative methods are of great interest for the industry. In this project we have developed a boron-based molecular sponge that is capable of interacting with aromatic molecules. Specifically, a highly electron-deficient host recognizes aromatic molecules through interactions. The studied aromatics include benzene, toluene, thiophene, and benzothiophene. We have determined the nature of the chemical recognition through single crystal X-ray diffraction analysis. We anticipate that our method is a cost-effective and environmentally friendly approach to recognize and capture molecules of interest 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)

Growth of Auditory Reflexes with Stimulus Level

In the human auditory system, the brainstem can modify how sound is processed in the inner ear (cochlea). The medial olivocochlear efferent reflex (MOCR) is one such inhibitory neural response originating in the brainstem. When activated, this reflex reduces amplification in the cochlea, which is believed to improve hearing in background noise. Previous research has shown that the reflex reduces amplification in the inner ear by different amounts for soft vs. loud acoustic stimuli. We hypothesized that these varying levels of reduction are equivalent to a constant reduction of stimulus input. To measure these level changes, we used otoacoustic emissions, which are soft sounds emitted from the cochlea that can be measured with a small microphone placed in the ear canal. Otoacoustic emission amplitudes obtained with MOCR activated were consistent with the equivalent constant shift hypothesis. These findings suggest a much larger effect of MOCR activation than has been reported using standard measurement paradigms.

41. Abby Fronk

Major: Biology

Mentor: Shujie Yang (Obstetrics and Gynecology)

Designing and utilizing an endogenous PR reporter gene for drug screening and mechanistic discovery in endometrial cancer

Expression of progesterone receptor (PR) is a favorable prognostic marker for multiple solid tumors. However, PR expression is reduced or lost in malignant tumors. Thus, monitoring and restoring functional PR expression is important to sensitize progesterone therapy in endometrial cancer. We developed a stable endometrial cancer cell line expressing the endogenous PR reporter gene containing Hygromycin and mCherry using CRISPR/Cas9-mediated genome editing technique. This allows efficient, real-time monitoring of PR expression in its native epigenetic landscape. To validate the correlation between PR and reporter gene expression, cells were treated with drugs known to induce PR expression, and the reporter gene faithfully increased in parallel with PR at a higher magnitude, making it a sensitive PR detector. Using this unique reporter gene, potential PR inducers including CUDC-907, Carfilzomib, and romidepsin have been identified from the FDA-approved 1018 drug library through high-throughput screening. Additionally, several candidate PR repressors including SOX9, GLUD2, APH1A, and BCAS4 have been identified by screening of the GeCKO (Genome-Scale CRISPR Knock Out) library. These tools provide a systematic, unbiased approach for monitoring target gene expression- critical for drug discovery and mechanistic exploration in many fields.

43. Carly Garcia

Major: Speech and Hearing Science

Mentor: Jerald Moon (Communication Sciences and Disorders)

Service Utilization of Patients Managed by a Cleft Palate Team. System-wide impact within a Tertiary-Care Hospital System

Team-based approaches to care are typically considered best practice (ACPA, 1993). However, scientifically supporting this idea is difficult, necessitating further research to determine its effectiveness. In this study the impact of caring for patients with cleft lip and palate (CLP) on a hospital system, its clinicians, and on the patients and families themselves, was analyzed.

Service utilization data from CLP Team patients from 2013-2017 was used (n=777). Insurance billing data, most visited specialties, number of specialties scheduled per visit, distance to travel, and demographic variables were analyzed within and across years and by visit type (arrived/completed (AC) or no-show/cancel (NSC)).

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 when all patients traveled 50 miles or less. This trend changed in later years with increased distance and number of specialties scheduled per visit.

As more specialties were scheduled within one visit, the effects seem to benefit patients, 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)

Using Electrocochleography to Hunt for Evidence of Hidden Hearing Loss in College Students

Hidden Hearing Loss (HHL) is a condition where individuals may have normal hearing but difficulty understanding speech in background noise. In 2016, Liberman et al. reported data obtained from musicians considered “at risk” for HHL versus a control group. In his study, individuals “at risk” for HHL scored significantly lower ($p < 0.05$) on a speech-in-noise task (NU-6) and exhibited significantly worse hearing for audiometric frequencies above 8000 Hz ($p < 0.001$). Liberman et al (2016) recorded summing potentials (SP), generated by cochlear hair cells, and compound action potentials (AP), response of the auditory nerve, from both groups. Larger SP:AP ratios were recorded for individuals in the “at risk” group compared with the control group ($P < 0.01$), suggesting this electrophysiologic measure might be used to diagnose HHL. In our partial replication, we recruited eleven normal hearing subjects where we tested hearing, surveyed noise exposure history, and documented output levels of headphones. Through this, we identified risk factors of hearing loss and found a significant correlation between number of risk factors per subject and performance on the NU6, consistent with our hypothesis that HHL may simply reflect noise exposure. However, for our cohort, SP:AP ratios for individuals “at risk” and controls were not significantly different.

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 vertices to represent products and using edges to represent the rate of dual consumption that falls below a specified threshold. The main difficulty is determining the chromatic number of the model graph and applying algorithms that would provide a vertex coloring. This project analyzes the computational complexity of algorithms used to produce a coloring of such graphs. A group of vertices of the same color would correspond to a group of products that would likely benefit from being advertised together.

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

Metabolic dysregulation is a cluster of cardiometabolic risk-factors that increase the likelihood of developing a chronic illness like heart disease. The relationship between physical activity (PA) and these factors has been studied in breast cancer patients, but no study has examined this relationship in ovarian cancer. We predicted patients with high metabolic dysregulation at diagnosis will see significant change in relevant biomarkers post-chemotherapy. Furthermore, we expected PA at baseline to predict dysregulation at 1-year. Using medical record data, we defined metabolic dysregulation as two or more of the following conditions: hypertension, lipid/glucose imbalance, and BMI ≥ 30 kg/m². PA data came from the Godin-Shephard Leisure-Time Questionnaire. Prior to surgery, 171 patients had high cardiometabolic dysregulation; this significantly improved by 1-year ($p < .001$). After controlling for advanced stage and chemotherapy status, baseline metabolic composite predicted metabolic composite at 1-year ($p = .019$). However, baseline PA did not predict baseline ($p = .544$) or 1-year metabolic composite scores ($p = .524$). In a sample of ovarian cancer patients, cardiometabolic risk factors prior to treatment predicted metabolic dysregulation at 1-year, but pre-surgery physical activity was not significantly correlated with dysregulation at either time-point. Future research should investigate if exercise interventions attenuate cardiometabolic risk factors and impact clinical outcome

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 the inhibition of drug seeking using animal models. Previous research using a rat model of addiction has revealed that the infralimbic cortex (IL) is crucial in mediating 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 as animals learn to decrease their cocaine seeking. This study used in vivo electrophysiology to record neurons within the IL as rats self-administered cocaine and experienced withdrawal from cocaine during extinction training. This study demonstrated that there are subgroups of neurons within the IL that respond to lever pressing, neurons

that respond to the availability-onset cue, and neurons that are involved in the decision to press the lever. Additionally, firing patterns in the IL change throughout extinction training—as animals learn to decrease their cocaine seeking, neurons fire more frequent and greater bursts of action potentials, imposing a greater effect on abstaining from cocaine. This study illustrates the involvement of the infralimbic cortex in modulating cocaine-seeking behavior.

53. Yuwei Guo

Major: Biochemistry

Mentor: Huojun Cao (Endodontics)

Profiling gene expression in the epithelial and mesenchymal compartments of developing rodent incisor.

Objectives: Teeth are developed from the crosstalk of dental epithelial and mesenchymal tissues. Tooth development occurs in stages, and the process begins under the control of the oral epithelial tissue. The epithelial tissue of the dental placode instructs the development of the tooth by synthesizing signaling molecules including Shh, Wnt, Bmp and Fgf signals. These signaling pathways control the expression of specific transcription factors in the epithelium and mesenchyme. One of the earliest transcription factors to be expressed in the dental epithelium is Pitx2 (paired-like homeodomain transcription factor 2). We are interested in what initiates the expression of the transcription factor Pitx2 and the formation of the primary tooth germ.

Methods: To determine what gene regulatory network is required for tooth germ initiation, we profiled gene expression in the developing oral epithelium and mesenchyme during early stages of tooth development (E9.5, E10.5, E11.5 and E12.5). We used Laser Microdissection (LMD) to isolate epithelial and mesenchymal tissues from early embryonic stages of tooth development. After tissue isolation, we extracted RNA and performed RNA-seq using the SMARTSEQ-2 protocol. **Results:** We made libraries to profile the transcriptomes of the first brachial arch of E9.5 and E10.5 murine embryos, and used LMD to isolate the epithelial and mesenchymal tissues to make libraries from E11.5 and E12.5 stages.

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 explores the 99 counties of Iowa and examines their relationships with severe weather. We display each county's events on our website through an interactive map of Iowa. Yale's "Six Americas" frames how the project seeks to communicate with readers. Iowans serve as our primary audience. Each story delves into a county's history (from the early 1800s to present day), often identifying underrepresented groups, such as Native Americans, Latinx, settlers, and immigrants who were affected by severe events. By writing with effective climate communication, we engage individuals who may not see their homes as being affected by climate change. Our project focuses on six hazards: droughts, floods, insects, heat, blizzards, and tornadoes. Each narrative identifies at least one of these hazards and explains the impacts they had on the area. The reader is prompted to explore the risk further when the website directs them to our scientific explanations of the hazard as related to climate change, as well as interviews conducted with Iowan climate scientists. This method of story-telling helps to advance the reader to engage with climate change and climate justice.

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. The identification of faunal remains can help us recreate the environment and food ways of the prehistoric peoples that inhabited this site. 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 breakage morphology. Quantification analysis determined that subsistence efforts were focused primarily on the hunting of white-tailed deer (*Odocoileus virginianus*). Other species that were identified include bison, elk, dog, raccoon, opossum, rabbit and squirrel.

69. Jacob Lam

Major: Biochemistry

Mentor: Antentor Hinton (Internal Medicine)

Insulin Stimulation Promotes Cristae Morphology Changes through OPA-1 Mechanism

Insulin stimulation in muscle cells increases mitochondrial fusion and cristae density through an Optic Atrophy Protein-1 (OPA1) dependent mechanism. It

has been shown that Mitofilin and CHCHD6 forms a complex with OPA1 at Cristae Junctions (CJ) and connects with the Mitochondrial Contact Site and Cristae Organizing System (MICOS) proteins, such as CHCHD3 and with Sam50 to sustain cristae architecture. Augmentation of mitochondrial oxidative metabolism by insulin may be mediated by other cristae proteins. Therefore, we hypothesized that insulin stimulation tightens CJ by inducing changes in MICOS. Next, we used Cre-LoxP technology to ablate OPA1 in murine muscle and found reduced protein levels of Mitofilin and CHCHD3. Cre-LoxP or CRISPR was used to ablate OPA1, CHCHD3, or Mitofilin in primary fibroblasts, primary murine, and human myoblasts. 2-hours of insulin stimulation increased OPA1 protein levels and cristae number in murine and human myoblasts. Consequently, the depletion of OPA1 blocked the metabolic effects of insulin stimulation. Transmission electron microscopy (TEM) was utilized to observe mitochondrial cristae after the ablation of OPA1 with insulin or without insulin in murine myoblasts. Live imaging with Mitotracker demonstrated altered mitochondria dynamics after OPA-1, CHCHD3, or Mitofilin ablation. Together, insulin stimulation promotes changes in cristae morphology.

71. Michael Leaman

Major: Human Physiology

Mentor: Kathleen Markan (Pharmacology)

Investigating the Role of TBX1 in Beige Adipocyte Development

Beige adipocytes express high levels of uncoupling protein 1 (UCP1) which uncouples oxidative phosphorylation from ATP synthesis resulting in the dissipation of energy as heat and thus increasing energy expenditure. Therefore, it has been hypothesized that increasing beige adipocyte 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 adipocytes. To test if TBX1 is sufficient and necessary to convert mature adiponectin expressing adipocytes into beige UCP1 positive adipocytes and potentially prevent the development of obesity, we generated two novel mouse models allowing for adipocyte specific overexpression of TBX1 (TBX1 AdipoTG) and adipocyte specific deletion of TBX1 (TBX1 AdipoKO) in vivo. Collectively, these data suggest that although adipocyte TBX1 regulates UCP1 expression in subcutaneous adipose, its expression in mature white adipocytes 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 5-HT serotonergic neurons in seizure susceptibility across vigilance states

Epilepsy is a condition in which patients experience recurrent seizures. Seizures occur in a sleep-state dependent manner with more seizures happening during wakefulness and non-rapid eye movement (NREM) sleep and almost no seizures occurring during rapid eye movement (REM) sleep. The mechanisms for this state dependence are not well-understood. The neurotransmitter serotonin (5-HT) modulates sleep-wakefulness and also modulates seizure occurrence. Some 5-HT neurons change their firing patterns in a sleep state-dependent manner. We hypothesized that eliminating 5-HT neurons would alter the sleep state dependence of seizures. To test this, a mix of male and female *Lmx1^{bf/f}* wild type and *Lmx1^{bf/f/p}* 5-HT neuron deficient knockout mice were rendered epileptic using the pilocarpine model of epilepsy, instrumented for EEG and EMG recording, and subjected to 7-10 days of EEG/EMG recording to assess sleep state and seizure occurrence. Preliminary analyses indicate that 5-HT deficiency did not change overall seizure occurrence, but did increase seizure occurrence during REM sleep. Further analyses need to be conducted. Future studies may investigate the source of 5-HT and site of action of 5-HT in regulating seizures.

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 SAMS_{N1} protein acts as a negative regulator to the antibody immune response in humans. The Kalwrij mouse strain can be used as a human multiple myeloma model and has the Samsn1 deletion among other mutations. To test if SAMS_{N1} acts as a negative regulator in a pro-myeloma model, it was hypothesized that the Samsn1 deletion in the mouse model would not negatively regulate antibodies. An experiment was performed using the Kalwrij model as well as a B6 model testing the immune responses. Contrary to what was expected, T-Cell independent immune response was not amplified as expected in the Kalwrij model, but the T-Cell dependent IgG immune response was augmented. Further experiments are being conducted to test IgG and IgM antibody levels to assess immune response over time using F2 mice which are a chimeric mix of Kalwrij and MYC mice as well as HACS mice which contain only the SAMS_{N1} deletion and no other mutations. Through these experiments, it could be determined how the silencing of SAMS_{N1} modulates the immune response and more specifically, its implications on the development of multiple myeloma.

81. Jade Miller

Major: Biochemistry

Mentor: Maria Spies (Biochemistry)

Interactions of BG4, FANCI, and REV1 with G4 Quadruplexes

Human DNA typically exists as a double helix, but certain regions of DNA containing four or more sets of guanines in a row, allowing these guanines to

bind with the guanines on neighboring sections of the motif. This forms what is called a G4 quadruplex, a structure where one strand of DNA loops back on itself due to these bonds. G4 quadruplexes block the unwinding and subsequent transcription of such DNA strands. This project aims to characterize the binding patterns of the proteins REV1 polymerase, FANCD1 helicase and BG4 by or with these DNA quadruplexes, and the resulting effects on DNA transcription downfield of the quadruplex. These sequences are present especially in telomeric regions of human DNA, so the results of this project have large-scale impacts on the understanding of DNA senescence, protein structure and function, and protein-protein interactions.

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)

Enhancing Spatial Variant Analysis for Clinical Genetic Testing

Interactive protein visualization is an important factor in aiding in the study of clinical genetic variants and their relationships with genetic diseases. One such applicable genetic disease is deafness. The Molecular Otolaryngology and Renal Research Laboratories (MORL) primarily uses experimental studies to provide a patient-specific diagnosis for those with hearing loss. The MORL curates the Deafness Variation Database (DVD), a comprehensive database of sequenced genetic mutations implicated in hearing loss. Recent work has been done to develop algorithms and high quality models of proteins implicated in deafness that augment patient-specific diagnoses, particularly where experimental studies are not feasible. Through the integration of interactive visualization tools using high quality protein models, the protein models become easily accessible and directly translatable to patient data. Using an NGL three-dimensional molecular visualization tool, the user gains the ability to spatially analyze variant positioning on the protein model, which will allow for the high quality structures to make a more direct computational impact on deafness studies.

89. Mara O'Connor

Major: Human Physiology

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

The behavioral and neuronal impacts of BCAA replacement for autism-associated BCKDK gene mutations

Introduction: The branched chain ketoacid dehydrogenase kinase (BCKDK) regulates the metabolism of branched chain amino acids (BCAAs). Loss of function mutations in BCKDK lead to over-catabolism of BCAAs. Interestingly, BCKDK mutations have been found in patients with autism spectrum disorder (ASD). Previous research demonstrated that BCKDK knockout mice have greater volume and density of active neurons in caudate putamen than wild type mice. The present study sought to examine the impact of BCKDK

knockout on behavior as well as the ability of direct BCAA infusion into the caudate putamen to rescue neurobiological and behavioral phenotypes of BCKDK knockout mice. **Methods:** BCKDK knockout mice were tested by rotarod to measure changes in procedural learning. Cannulas were implanted in caudate putamen to infuse either BCAAs or saline. Anxiety-associated grooming behaviors were assessed, and active neuron populations of the caudate putamen were measured with cfos immunohistochemistry. **Results:** BCKDK KO mice had better procedural learning than wild type. Preliminary data suggest that BCAA infusion resulted in differences in active neurons in caudate putamen and grooming behavior in wild type and BCKDK KO mice. **Conclusion:** The results contribute to our understanding of how BCKDK mutation causes Autism Spectrum Disorder and how treatments could be developed.

91. Erik Ovrom

Major: Interdepartmental Studies

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

Isolation of Gallium Substituted Polyaluminum Clusters in Aqueous Solution

In aqueous systems, hydrolysis of aluminum results in a diverse array of oxyhydroxide clusters, which resemble clay and mineral surfaces in the environment. Among these clusters, the most common is the Baker-Figgis-Keggin $[\text{MO}_4\text{Al}_{12}(\text{OH})_{24}(\text{H}_2\text{O})_{12}]^{7+}$, where the tetrahedral site (MO_4) can be substituted by different metals including Al, Ga, and Ge. Depending on the conditions, the Keggin clusters may assume different configurations ($\hat{1}\mu$, $\hat{1}'$ and $\hat{1}^3$) and/or form bigger clusters. Understanding the chemistry that underlies their formation is important in elucidating details of geochemical processes and mineral surfaces. But, a lack of knowledge complicates their isolation and identification in aqueous solution. To date, heteroatomic Keggin clusters have only been isolated in the $\hat{1}\mu$ configuration. Furthermore, heteroatomic aluminum clusters that have more than 12 Al units are rare in the literature. In the present study, we synthesized Ga-substituted polyaluminum clusters of different sizes and configurations by titrating a solution containing AlCl_3 and GaCl_3 with NaOH at 90 degrees Celsius. The resulting solution was then aged at 90 degrees Celsius for several days to drive the formation of different clusters. Using a variety of crystallizing agents, we isolated several novel clusters, one with the $\hat{1}'$ configuration and others with more than 12 Al units.

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 (CSCs), a subpopulation of cancer cells, display unique

characteristics such as self-proliferation and self-renewal, which may support metastasis and tumorigenesis. Additionally, CSCs display resistance to current chemoradiotherapy, and may be responsible for recurrence and metastasis after primary treatment. Sumoylation, a post-translational protein modification pathway, has been shown to support the CSC phenotype. Studies have shown that Topotecan, a topoisomerase 1 inhibitor, has the ability to decrease the sumoylation of proteins. This study investigates how topotecan affects CSCs by measuring the expression of CD44 cell surface markers. Treatment of the colon cancer cell line HCT116 with topotecan was performed in vitro and the CD44 levels decreased as shown by western blot. In addition, three colon cancer PDXs in a mouse xenograft model were treated with topotecan and analyzed using flow cytometry. In one PDX, topotecan was successful in decreasing CD44 expression. However, in two PDXs, CD44 expression increased. Further analysis is needed to determine which patients would benefit from Topotecan treatment.

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. They 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. It has been previously determined that the ARCH domain of XPD is dynamic, and has the ability to transition between an open and closed state. It has also been found that the ARCH domain favors the closed state when exposed to damaged DNA, which suggests a role in damage recognition. It has been found that mutations that take place in the ARCH domain of XPD could have a potential effect on DNA damage recognition. We are investigating the potential impacts these mutations may have on ARCH domain movement. To do this, we will be contrasting the ARCH domain dynamics of mutant and wildtype XPD. This will allow us to observe changes in ARCH domain mobility due to the mutations that may have an impact on XPD activity. Moreover, we are hoping that these experiments will give us more informed insights into the mechanisms of XPD and other genome caretakers. A broader understanding of these molecules will hopefully provide insights on their connection to human disease, which would have applications regarding the way they are treated.

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

Introduction: Although systolic blood pressure increases during exercise, diastolic blood pressure (DBP) typically remains constant or decreases slightly. An increase in DBP during exercise is associated with increased cardiovascular disease (CVD) risk. However, the mechanisms underlying this abnormal DBP response remain unknown. Individuals with chronic obstructive lung disease (COPD) have impaired vascular endothelial function but it is unknown if endothelial dysfunction contributes to an abnormal DBP response during exercise in COPD. We hypothesized that lower endothelial function would be associated with increased DBP during exercise in individuals with COPD.

Methods: Fifteen individuals with COPD (age 72 ± 6 ; 6 males/ 9 females) completed measurements of brachial artery flow-mediated dilation (FMD) and 6-minute walk test (MWT). Brachial blood pressures were collected before and immediately following the 6MWT.

Results: Lower FMD absolute change (FMDmm) was associated with both greater percent change ($r=-0.64$, $p=0.01$) and absolute change ($r=-0.66$, $p=0.01$) in DBP during the 6MWT. After adjusting for pre 6MWT DBP, FMDmm remained associated with both percent change ($r=-0.60$, $p=0.02$) and absolute change ($r=-0.62$, $p=0.02$) in DBP.

Conclusion: The findings suggest that endothelial dysfunction is a potential mechanism that underlies abnormal BP response to exercise in this patient 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

Tight junctions (TJ) form intricate protein networks that are fundamental to cellular functions and communication. In the inner ear, TJ are required for maintaining ion homeostasis and their defects have been linked to deafness. A duplication of the Tight Junction Protein 2 (TJP2) gene has been previously linked to autosomal dominant nonsyndromic hearing loss through a dosage effect. In this study, we aim to identify the genetic cause of hearing loss in a large Iranian family using a next generation sequencing platform that screens all known deafness-causing genes. After bioinformatic analysis, we have identified a variant in the canonical splice-donor site; c.2811+1G>A, in TJP2 gene. To test the functional effect of this variant on splicing, we performed mini-gene assays in mammalian cells. We showed that the mutant TJP2 construct affects normal splicing by causing exon skipping and an in-frame 80 amino acid deletion of the acidic region which is involved in actin binding. This is the first study showing that mutant TJP2 protein acts in a dominant negative manner on the function of the TJ complex by altering its binding to actin. Understanding genetic variant effects is fundamental to illuminating disease mechanisms and creating future novel molecular therapies.

105. Marissa Roseman

Majors: Biology, Environmental Science

Mentor: Maurine Neiman (Biology)

Genomic and Functional Tests of Mitonuclear Coevolution

Muller's ratchet proposes that asexual populations should accumulate deleterious mutations in the absence of effective selection. However, the persistence of asexuality in the face of this suggests a means by which protein function is conserved in asexual populations. We aim to explore this paradox by addressing whether higher substitution rates in critical mitochondrial genes in asexual populations of *Potamopyrgus antipodarum* drives compensatory coevolution between mitochondrial and nuclear genomes. This New Zealand freshwater snail is characterized by coexisting sexual and asexual lineages, making it an excellent model organism for studying the genetic effects of sexual mode. Asexual lineages also exhibit surprising mitonuclear discordance, in which individuals sharing a mitochondrial background may have a variety of different nuclear backgrounds. Our study uses both genetic data and mitochondrial fitness assays to evaluate mitonuclear coevolution and assess its phenotypic effects. Though the project is ongoing, my poster presents our predictions, rationale 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)

Bardet-Biedl Syndrome: Modeling Cellular Transport Defects and Vision Impairments In The Zebrafish

Retinitis pigmentosa, a symptom of the human genetic disorder Bardet-Biedl Syndrome (BBS), is caused by death of photoreceptor cells, resulting in

blindness. Defects in the BBS pathway in zebrafish have been shown to cause melanosome trafficking defects, but cellular trafficking defects in the retina, which may explain photoreceptor death, have not yet been shown. This project seeks to quantify the trafficking patterns of transgenic eGFP-tagged BBS12—a member of a chaperonin complex that constructs the BBSome, which in turn constructs cilia—using immunohistochemistry and confocal imaging. It also uses a behavioral assay to quantify visual function in BBS12 fish. The vision assay revealed no significant difference between gnat2:BBS12-eGFP and wild type fish, demonstrating the utility of this line since the presence of fluorescence in the eye does not reduce visual function. Confocal imaging showed gnat2:BBS12-eGFP accumulated in the zebrafish eye in the nuclear layer at a low level and in the RPE layer at a high level. This suggests that overexpression of BBS12 by the transgenic construct may be causing nuclear layer death and consequent shuttling of BBS12 to the RPE. Future directions involve knocking down endogenous BBS12 to see if transgenic BBS12-eGFP can be observed at a higher level.

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)

Effects of Irrelevant Information during Forced Choice Task

Past studies have been done to show that other stimuli relevant to what we are attending to is also noticed by us. However, we don't know if stimuli that are irrelevant to what we are attending to still affect us. We utilized a simple forced-choice task and randomly assigned participants to one of two variables: shape or color. Three colors were mapped to the left-handed response, while three other colors were mapped to the right-handed response. The same was also true for shapes, but participants were tasked with only making their choice based on their assigned variable. During the experiment, certain colors were more highly

correlated to certain shapes, while some combinations of colored shapes didn't appear at all. Results in our first experiment found a significant difference in reaction time between congruent and in-congruent trials for participants responding to shapes, but not participants responding to color. One possible reasoning behind why these results occurred would be due to how different parts of the brain activate when we are shown a stimulus. Color cannot exist within the world without a shape, and because of this it is possible that our brains have developed so that we perceive the shape of an object first and then fill that object in with color.

115. Jeffrey Shymanski

Major: Speech and Hearing Science

Mentor: Elizabeth Walker (Communication Sciences and Disorders)

Competitive Learning Processes: The Role of Verbal Mediation in Sequential Learning

Sequential learning is a statistical learning mechanism supporting extraction of rule-based linguistic patterns. Children born deaf lack early access to spoken language. Some research suggests this period of deafness restricts sequential learning development. However, sequential learning paradigms may measure different constructs depending on task stimuli—easily verbalized stimuli may be encoded and maintained by higher-order, language-dependent mechanisms (e.g., verbal mediation) rather than domain-general statistical learning mechanisms. The current feasibility study addresses three questions: (1) do children demonstrate sequential learning with verbally mediated stimuli, (2) does verbal mediation affect explicit learning of stimuli sequences, and (3) do cognitive/linguistic skills predict sequential learning? Researchers tested 25 children with normal hearing using a battery of cognitive/linguistic measures and two sequential learning tasks, which included either verbally or nonverbally mediated stimuli sequences. Results showed that children demonstrate sequential learning with nonverbally, but not verbally, mediated sequences. Explicit sequence recall did not differ significantly by task. Lastly, expressive vocabulary was negatively associated with performance on the verbally mediated sequential learning task; children with larger vocabularies demonstrated reduced sequential learning. These findings suggest a competition between general and higher-order learning systems.

117. Maggie Sadders

Major: Biology

Mentor: Toshihiro Kitamoto (Anesthesia)

Genetic Screen for Seizure Suppressors Using 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 (AEDs) on the market, but nearly 30% of patients do not properly

respond to these currently available 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 phenotypes of the *Drosophila* voltage-gated sodium channel mutant, Shudderer (Shu) - a fly model of human epilepsy. Our extensive genetic screen, examining more than 300 deficiencies, led to the identification of several chromosome regions that may potentially contain genetic modifiers of Shu. Using molecularly defined smaller deficiencies, we were also able to narrow down one such region to ~80Kb of genomic fragment on the left arm of 2nd chromosome where approximately twenty-three genes reside. In the current project, we knocked down fourteen genes individually using an RNAi and identified at least three genes, Chd1, α 4GT1 and SerRS, which appear to play important roles in the exhibition the epilepsy-like behavior. These findings open up a new area for discovery of novel AEDs.

119. Matthew Sovers

Major: Environmental Science

Mentor: Betsy Stone (Chemistry)

Effects of Co-firing Biomass and Alternative Fuels on Emissions and its Impacts on Air Quality

The University of Iowa looks to reach 40% renewable energy consumption by 2020, and eliminate the use of coal by 2025. To achieve this goal, alternative fuel sources are used with, or in place of coal. Alternative fuels such as biomass and recycled plastic materials reduce fossil CO₂ emissions. This study analyzes gas and particle phase emissions when firing renewable fuels either on their own, or together with coal, and evaluates their effects on air quality, specifically polycyclic aromatic hydrocarbons (PAH), particulate matter (PM) and metal emissions. Two different fuel sources, a biomass blend with coal, and recycled plastic materials called energy pellets were investigated in two separate boilers. Co-firing a blend of 78% oat hulls, 17% coal, and 5% energy pellets reduced PM, greatly reduced metal emissions, and showed moderate reduction in PAH output by 11.5, 50, and 33% respectively. Energy pellets alone increased PM and PAH generation but, showed reduction of metal emissions by 80%, however increased PAH and PM emissions by 28 and 76% respectively. It is important to investigate the introduction of emissions in utilizing alternative fuels to reach energy needs while maintaining and improving local 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

Spoken word recognition is a challenging task. This is because speech unfolds over time and many words sound the same. What results is temporary

ambiguity. For example, after hearing the onset of the word "candle" it is quite difficult to know what the word is because there are many other words that begin the same (e.g., cap, can, etc.). Normal hearing (NH) listeners manage this ambiguity by immediately activating multiple candidate words that align with the speech signal, and as the word unfolds, they suppress words that no longer match the signal. Most of the research on spoken word recognition concerns speech presented at a conversational level and far less is known about speech in adverse listening conditions. The goal of the study is to determine how listeners recognize words in the presence of soft speech. This study uses eye-tracking and the visual world paradigm (VWP) to observe online processes of how listeners recognize words at a soft input level.

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)

The association between parental supportiveness and control and children delay of gratification: the mediating role of 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 and 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)

Platelet Specific Deletion of UCP-2 Reduces Frequency of Thrombus Formation

Increased platelet activity can result in thrombosis, a common symptom of cardiovascular disease. Uncoupling Protein (UCP)-2 is a protein located in the inner mitochondrial membrane which mediates proton leak, and it was found that people who were at higher risk of cardiovascular disease had increased transcripts for UCP-2 in their platelets. It is unknown whether an increase in UCP-2 represents a physiological adaptation or contributes to pathophysiology. To assess the relationship between platelet mitochondrial UCP-2 levels and platelet function and thrombosis, we created a mouse model with a platelet-specific UCP-2 deletion.

UCP-2 KO platelets from these mice displayed altered mitochondrial energetics, with both higher basal and ATP-linked respiration rates than control platelets. This suggests that knockout platelet mitochondria are either more active or more efficient. Despite this, three independent measures of thrombosis revealed that knockout platelets contributed to a bleeding phenotype. UCP-2 KO platelets displayed reduced agonist-induced activation. UCP-2 KO mice took longer to reach stable hemostasis in a tail bleeding study and showed reduced propensity to form a thrombus after permanent ligation of the inferior vena cava. These results suggest that, despite an apparent increase in mitochondrial activity, UCP-2 deletion is protective against thrombus formation. Thus, increased UCP-2 in platelets may be a risk factor for cardiovascular disease.

131. Alexandria Sturtz

Major: Microbiology

Mentor: Noah Butler (Microbiology and Immunology)

3H3 and Artemether combination as a potential therapy against repeated Plasmodium infections

The clearance of Plasmodium parasites during infection depends on Plasmodium-specific antibody responses orchestrated by T follicular helper (Tfh) cells in germinal centers (GC). However, humoral responses are often delayed and low-quality, leading to a lack of sterilizing anti-malarial immunity. Agonists of 4-1BB, a co-stimulatory tumor necrosis factor receptor superfamily (TNFRSF) member, trigger T cell expansion and are used as a therapy in cancer models. We hypothesized agonizing 4-1BB with a monoclonal antibody (a4-1BB) during Plasmodium infection would improve Tfh responses. However, a4-1BB treated mice showed delayed GC formation and consequently had a prolonged parasite burden. Despite this, a4-1BB treated mice had heightened memory B cell responses and were more resistant to a challenge with a lethal strain of Plasmodium. Although a4-11BB treatment offers protection against a lethal challenge, the exacerbated parasite burden during the primary infection prevents the use of a4-1BB as a viable therapy. To circumvent this, we used a combinational treatment of a4-1BB with an antimalarial drug, artemether, to mitigate the initial rise in parasitemia. This combinational treatment still elicited protection against a lethal challenge. Thus, our data support a4-1BB plus artemether as a potential therapy to improve anti-malarial GC responses and render protection against repeated Plasmodium 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, bidirectional communication exist between the gut microbiota, a diverse community of microorganisms, and the brain. However, the underlying mechanisms and functional significance still remain largely elusive. To address this issue, we take advantage of paraShu, a voltage-gated sodium (Nav) channel mutant of the fruit fly *Drosophila melanogaster*. Nav channels are responsible for generation and propagation of action potentials, and thus play a central role in regulating neuronal excitability. We examined the extent to which endogenous gut microbiota contributes to the manifestation of seizure-like phenotypes in paraShu. Our study revealed that the 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 of the *Lactobacillus* or *Acetobacter* genera into germ-free mutants exacerbated the phenotypic severity, indicating that indigenous prokaryotic microorganisms contribute to the paraShu phenotypes. 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 post-ictal generalized EEG-suppression

Sudden unexpected death in epilepsy (SUDEP) is the leading cause of death in patients with refractory epilepsy. The etiology of SUDEP is unknown. A potential risk marker for SUDEP is the duration of post-ictal electroencephalographic (EEG) suppression (PGES), a period of reduced amplitude brain activity following seizures. The mechanism underlying PGES is unknown. Serotonin (5-HT) has been implicated in SUDEP, thus we hypothesized that 5-HT modulates 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 optogenetic stimulation of DRN 5-HT neurons could decrease PGES duration. To test this, mice expressing Channelrhodopsin2 (ChR2) in DRN 5-HT neurons and wild-type littermates were instrumented for EEG/EMG recording, amygdala stimulation for seizure induction, and optogenetic DRN stimulation. Following recovery from surgery, animals received light stimulation to DRN for 10 minutes prior to seizure induction. Optogenetic stimulation of DRN 5-HT neurons reduced PGES duration in mice expressing ChR2, but not control mice. Future experiments could address the role of 5-HT in PGES in structures downstream of the DRN, such as the hippocampus which is 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

CO₂-induced arousal is a critical mechanism in protection against hypercapnia. Impairment of this regulatory mechanism occurs in obstructive sleep apnea, sudden infant death syndrome, and sudden unexpected death in epilepsy. During CO₂-induced arousal, activation of serotonin neurons in the midbrain dorsal raphe nucleus is important. It is unknown which brain regions are activated downstream of the midbrain dorsal raphe nucleus. We examined activation of c-fos, an indication of neuronal activity, in potential arousal regions. Adult male wild type and serotonin neuron-deficient mice were challenged either systematically or via direct midbrain dorsal raphe nucleus activation. Inspiration of CO₂ (or room air) activated the brain regions systemically. Perfusion of CO₂-enriched artificial cerebrospinal fluid through a stereotactically implanted microdialysis cannula activated the midbrain dorsal raphe nucleus directly. Immediately following exposure, animals were euthanized, intracardially perfused, the brains extracted, cryoprotected, frozen, sectioned, and immuno-stained for c-fos. Potential arousal sites, including the medial septal nucleus, diagonal and horizontal bands of Broca, tuberomammillary nucleus, midbrain dorsal raphe nucleus, and pedunculopontine tegmental nucleus, are currently being examined for c-fos+ cells. Cells expressing c-fos will indicate which brain regions are most

important in the CO₂-induced arousal system.

149. Carolyn Lo; Alex Syverud

Majors: Human Physiology, Biochemistry; Public Health

Mentor: Jacob Michaelson (Psychiatry)

Systematic Optimization of Nanopore Based Next-Gen Sequencing

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)

Impact of MRI/A vs. CTA/P-based ED vs. Direct Angiosuite Triage Protocols in Stroke Care Performance and Outcome of Transferred Patients for Endovascular Thrombectomy

The purpose of this research project was to compare the door to treatment (skin puncture) time and clinical outcomes, such as the discharge Modified Rankin Scale (mRS) and by National Institutes of Health Stroke Scale (NIHSS) difference at admission and discharge, in transfer patients with acute large vessel occlusion stroke triaged by MRI/A, CTA/P, or DAN protocols.

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 and assessment of corticomotor connectivity 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)

Nutrition Quality and Improvement in Motor Function

Multiple Sclerosis, an autoimmune disease that attacks the body's neural tissues, 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 hypothesized that the Wahls diet group will experience significantly more fatigue reduction and greater improvements in overall nutrition quality than the Swank diet group. Descriptive baseline statistics from visit one will be reported. 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 progressive disease causing central nervous system degeneration. Former research studies have found that it's possible diet profiles have a stronger correlation to development and symptom prevalence 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 analysis of these MS participants following the modified Paleolithic intervention diet (no grain, legumes, dairy, high vegetables). Data from 19 participants were collected. Nutrient intake was determined using the 2007 Harvard semiquantitative food frequency questionnaire completed at baseline and at 12 months. On this questionnaire, participants reported how frequently various food items were consumed per day, week, month, or year. We assessed change in intake of important nutrients from baseline to 12 months. 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 fiber, omega 3, and antioxidant intake paired with a decrease in undesired total calories, carbohydrates, added sugars, glycemic index, and saturated fat.

16. Lauren Brown

Major: Speech and Hearing Science

Mentor: Anu Subramanian (Communication Sciences and Disorders)

Investigating the instruction of the therapeutic alliance in speech-language pathology clinical education

The therapeutic alliance is a common factor that has been found to predict positive outcomes across varying types of therapy. In research specific to speech-language pathology multiple studies have found that clients and clinicians have reported that therapeutic alliance is an important aspect of therapy. Although this 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 education of clinical graduate students in the field of speech-language pathology through the use of surveys. Individual surveys were created and distributed for both graduate student clinicians and clinical supervisors. 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 the emphasis put on the therapeutic alliance in the clinical education of graduate students in the field of speech-language pathology which can lead to more positive experiences for graduate students, clinical supervisors, and future clients.

18. Travis Carter

Major: Criminology

Mentor: Mark Berg (Sociology)

A Situational Analysis of Conflict Escalation and 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 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

Optic atrophy 1 (OPA1) regulates inner mitochondrial membrane fusion and cristae structure. Reduced myocardial OPA1 protein expression has been reported in human and animal models of heart failure. The present study sought to determine if cardiac specific OPA1 deficiency would cause mitochondrial dysfunction, heart failure and death. Inducible cardiac-specific OPA1 knockout

(KO) mice were generated by administering tamoxifen (5mg/kg) to mice on a C57BL/J background harboring OPA1 flox/flox and α MHC-MerCreMer transgenes for 5 days at 7 weeks of age. OPA1 protein was significantly decreased 4 weeks after tamoxifen injection, and female mice with OPA1 KO had reduced ejection fraction at 10 weeks and males at 12 weeks. Mice began to die 15 weeks after tamoxifen injection. Transmission electron microscopy revealed an increase in mitochondrial number and circularity index and a reduction in cristae number, volume and area ($p < 0.05$) after 8 weeks. Citrate synthase activity (-38%) and pyruvate/ADP driven mitochondrial respiration (-26%) was reduced 8 weeks post tamoxifen ($p < 0.05$). However, palmitoyl carnitine supported respirations were unchanged. OPA1 deficiency resulted in increased protein expression of ER stress markers at 4 week and mitochondrial UPR 8 weeks. This study concluded a loss of OPA1 leads to heart failure and premature death in both male and female mice with the earliest defects of ER stress preceding mitochondrial fragmentation and subsequent ventricular dysfunction

26. Ellyn Cramer; Tashmit Khan

Majors: Biology; English

Mentor: Chun-Fang Wu (Biology)

Light Intensity Modulating Male-Male Interaction in Fruit Flies

Animal propagation depends on individual interactions within the population. There are many categories of interaction among individuals throughout the lifespan of animals; each may be modulated by environmental factors which can influence the propagation of the species. Several forms of male-male interactions have been observed in fruit flies. We investigate how metabolic and lighting conditions affect behaviors between male flies. Reactive oxygen species (ROS) are produced during normal aerobic respiratory processes that must be efficiently cleared to prevent oxidative damage of cellular components that could lead to aging and neurodegenerative diseases. Superoxide dismutase (SOD) is the ROS scavenging enzyme, mutations of which result in 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" of a different genotype. We observed male-male chasing behavior between co-housed wild-type (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 both L-band (1-2 GHz) and S-band (2-4 GHz), 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 cosmic-ray 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 (Caretti 2013). 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. Observations of the polarization of both S and L-band will help to distinguish between thermal and non-thermal emission. 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. I will be examining both debitage and tools and categorizing them using macroscopic analysis and the Andrefsky categorization method. This allows us to determine what kind of activities occurred at the site as well as possible lengths of occupation.

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

This social psychological study utilized status characteristics theory and the standard experimental setting to examine the potential status hierarchies that form in task groups between Asian, Asian American, and White men with White women. I conducted a 3-condition, double blind experiment in The Center for the Study of Group Processes using a subject pool of White female undergraduate students at The University of Iowa. Status characteristics theory posits that within groups focused on completing a task together, individuals may assume their fellow group members are more or less competent based on their status characteristics, such as race or immigration status. Those expectations create group status hierarchies because individuals make these assumptions about both themselves and others. Their behavior then matches those assumptions. The preliminary results show that White female participants deferred 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)

Ovidian Myths and Language in Shakespeare's "Venus and Adonis"

In addition to a collection of source study scholarship relating to Ovid and Shakespeare, this Ovidian "database" goes line-by-line and word-by-word through Ovid's "Venus & Adonis" tale, noting repeated vocabulary, grammatical forms, and important notes. This is then compared with Shakespeare's "Venus & Adonis" for textual analysis and literary criticism.

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 examines proprietary data from Dun & Bradstreet of all grant recipients of the Department of Agriculture, Department of Energy, and Department of Health and Human Services from 1983-2017 and how awardees of the extramural grants fared since receiving their initial SBIR award. Descriptive models are employed to consider state-level sectoral growth in the formative years of the business, while firm and award characteristics are also considered. Such research will attempt to provide insights to favorable conditions that would suggest success in future applicants, where success is defined as a firm's survival, public listings, and merging or being acquired by a larger firm.

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

Hybrid cochlear implants are new hearing assistive devices, which combine acoustic and electric elements of auditory encoding. Traditional cochlear implants are not implanted until hearing is nearly gone, because they destroy the cochlea. Hybrid cochlear implants allow patients to be implanted earlier, so that they may use their residual acoustic hearing as an interpreter for their new electrical sound processing. This study analyzes the effects of hybrid cochlear implants on post-operative patient performance for phoneme identification, by measuring cortical auditory evoked potentials in brainwaves. Conducted in the summer of 2018, at the University of Iowa Hospitals and Clinics department of Otolaryngology, twenty hybrid cochlear implant users had cortical auditory potentials measured through Electroencephalography, or EEG, which were later analyzed using MatLab. Cochlear implant users demonstrate brain wave abnormalities during phoneme identification, termed auditory artifacts, which were manually removed by researchers for further data analysis. Patient phoneme identification progress was measured with a speech-in-noise test, on the California Consonant Test (CCT); a test in which a word is said in varying types of background noise, thereby reproducing the everyday auditory situations a hybrid cochlear implant user may experience. The current data collection is promising, and the data is being further analyzed.

50. Abby Haynes

Majors: Marketing, Economics

Mentor: Andrea Luangrath (Marketing)

Physical Mimicry of Visual Textual Paralanguage

Building upon prior research on mimicry and emotions, we propose that text-message recipients will facially mimic and, therefore, experience the emotions conveyed via textual paralanguage (TPL). In particular, we are interested in exploring if persons mimic the facial expressions of emojis, a particular type of TPL. Consequently, this work attempts to prove that the same mechanism by which emotions spread via face-to-face communication (rapid, non-conscious facial mimicry) applies to text-message communication due TPL usage. We executed 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. For females, we see a significant difference between the amount of joy expressed when seeing a happy vs. sad emoji. However, for males and for expressions of sadness, we see no significant difference.

Furthermore, we found no difference between the facial mimicry of human faces vs. emojis. 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 fEMG technology. 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 reaching an incidence of 1/59 children. The process for individuals with ASD of receiving this diagnosis is often protracted and challenging, requiring numerous health-care professionals. This has led to the need for reliable biomarkers of ASD, which could expedite current clinical methods of diagnosis. Addressing this, the aim of this study is to develop a machine learning model capable of predicting the likelihood of a newborn being diagnosed with ASD later in their childhood. To accomplish this, the Michaelson lab has acquired a large newborn screening tandem mass spectrometry (TMS) dataset. This dataset includes metabolite levels at birth of ~200 individuals with ASD and several thousand controls. Using machine learning, I trained a model capable of predicting ASD at birth with a sensitivity and specificity of 72.72% and 51.99%, respectively. Interestingly, individuals with autism show the greatest differential levels of Octenoylcarnitine, Citrulline, and Arginine. Moving forward, my analysis will include deep learning models, which may show superior performance. This study is the first attempted metabolite-based diagnostic test of ASD at birth 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

This project assesses the views of the character of candidates across different populations of supporters using popular natural language processing techniques—namely the machine learning model known as word embeddings. With a collection of millions of tweets surrounding the 2016 election, identifying the shifts in representations of the candidates by various populations (e.g. Clinton or Trump supporters) can speak volumes about the individuals, their supporters, and the message they propagate. A subset of these tweets, the accounts Twitter suspended by early in 2017 of both Clinton and Trump supporters and the tweets connected with the Russian IRA, were examined closely. A Word2Vec vocabulary was built using these tweets, and for each character representing word that appeared in the subset, a cosine similarity between its corresponding word vector and either the word vector for “Clinton” or “Trump” was established. Ranking these behavioral words by similarity and grouping together related behavioral words within the ranked list results in the graph of words that represent a candidate's character. This approach captures the larger meaning of these words relative to the names of the candidates as word embeddings consider occurrence count, location of the words, and context in which words may appear.

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

Low fidelity of HIV-1 replication machinery allows introduction of mutations in the viral genome. Occurrence of such events is random; thus emergence of escape variants from antibodies and therapeutics is considered unpredictable. The envelope glycoproteins (Envs) on the virus surface are attractive targets for therapeutics. The ability to predict emergence of escape variants from inhibitors before treatment could allow tailoring of antivirals to patients. We discovered that each position of Env exhibits a defined level of in-host variance, designated volatility, conserved in different hosts. We observed three types of clustering patterns of volatility: Genetic clustering: The pattern of variable sites in a patient is a transmissible property of each strain that persists in the recipient. Temporal clustering: Each Env position has a typical longevity of the high-volatility state after which it returns to a non-volatile state. Spatial clustering: The volatility of a given residue of Env is associated with the volatilities of adjacent positions on the Env trimer. We developed a forecasting model that integrates these patterns to predict future levels of volatility in each patient. We found the model predicts well appearance of high-volatility states at key positions of Env that mediate escape from inhibitors and antibodies. This model could be applied to tailor therapeutics to patients based on the calculated likelihood for emergence of escape mutants to each therapeutic agent.

66. Dariya Kozlova

Major: Biomedical Sciences

Mentor: Brandon Davies (Biochemistry)

Functional assessment of common human mutations in ANGPTL3

Dyslipidemia is a risk factor for the development of cardiovascular disease. Two key proteins that regulate lipid metabolism are lipoprotein lipase (LPL) and endothelial lipase (EL). Lipoprotein lipase hydrolyzes circulating triglycerides

into free fatty acids for uptake into tissues, while EL hydrolyzes the phospholipids of high density lipoprotein. Angiopoetin-like 3 (ANGPTL3) is an endogenous inhibitor of both EL and LPL. Genetic loss of ANGPTL3 is associated with decreased plasma triglycerides and may convey protection against cardiovascular disease. Recent GWAS studies have identified several human mutations of ANGPTL3 (G56V, K63T, M259T, F295L, R332Q) that are associated with lower plasma triglyceride levels. The aim of this study is to identify how these mutations alter the ability of ANGPTL3 to inhibit EL and LPL. We tested the expression and secretion of these mutants through western blotting. While the F295L and R332Q mutants are not expressed, G56V, K63T and M259T are able to be expressed and secreted. We performed EL inhibition assays with G56V, K63T, and M259T mutants and found no difference between wild-type and mutant ANGPTL3 protein. In the future, we plan to test LPL inhibition by these mutants and the ability of the mutant proteins to interact with ANGPTL8, an important cofactor.

68. Emily Laverty

Major: Neuroscience

Mentor: Rebecca Dodd (Internal Medicine)

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

Sarcomas are a diverse group of connective tissue tumors comprising approximately 1% of adult cancers and 15% of pediatric cancers. The profound heterogeneity of sarcomas presents a unique challenge when trying to understand and treat these malignancies. To date, few molecular targets have been identified for chemotherapeutic treatment. In collaboration with an ongoing phase 1b clinical trial at the University of Iowa, we are investigating a novel combination therapy using Decitabine (DAC), a DNA methyltransferase inhibitor, with Gemcitabine (Gem), an antimetabolite, for the treatment of soft-tissue sarcoma. Our data show that DAC/Gem combination treatment slows tumor growth and extends survival better than single-agent treatment alone. We have also found increased tumor-specific CD4 infiltration in DAC/Gem-treated mice. Our ability to test the combination treatment in an immune-competent primary sarcoma model developed by our lab is crucial to elucidating its therapeutic mechanism. We hypothesize that DAC improves the cytotoxic effects of Gem by changing DNA methylation profiles, resulting in recruitment of anti-tumor immune cells. In addition to characterizing tumor immune cell infiltration, we are examining RNA profiles and cytokine production. Furthermore, we aim to identify a prognostic peripheral blood marker using longitudinal blood samples from experimental mice and from patients who are part of the phase 1b clinical trial.

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 airborne particulate matter in Nepal

Particulate matter (PM) that is a major component of air pollution can lead to various health problems, especially respiratory and cardiovascular diseases when inhaled. PM_{2.5} and PM₁₀ have diameters less than 2.5 and 10 micrometers. The World Health Organization (WHO) ranked Nepal as having the 7th highest PM_{2.5} in the world in 2016. Air pollution can be reduced by investigating and regulating its sources. The objectives of our research are to 1) quantify the air pollutant levels in Nepal through measurement of PM_{2.5} and PM₁₀ mass and 2) identify and quantify sources of air pollution by measuring organic markers. PM samples were collected from Lumbini, Dhulikhel, Ratnapark, and Patan in Nepal during the winter (Dec 20, 2017, to Feb 10, 2018). The PM_{2.5} concentrations ranged 58-295 µg/m³ in Lumbini, 31-77 µg/m³ in Dhulikhel, 58-160 µg/m³ in Ratnapark, and 73-183 µg/m³ in Patan. The concentrations in all four locations were higher than the WHO guidelines of 25 µg/m³ for PM_{2.5} and 50 µg/m³ for PM₁₀. To identify sources of PM, organic species will be extracted using organic solvents and quantified using gas chromatography coupled with mass spectrometry. The analysis will focus on levoglucosan that is a tracer of biomass burning, hopanes that are tracers of fossil fuels, and 1, 3, 5-triphenylbenzene that is a tracer for plastic/garbage burning. This research will identify the major sources of PM and can contribute to developing strategies 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

Taxi services play an important role in public transportation systems. With smart cities developing quickly, more urban data is available to use. In this thesis, we collect urban mobility data to study urban traffic patterns. Analyzing urban mobility data and understanding human movement patterns based on traffic zone can facilitate smart cities. This is important because it can potentially help taxi services and analysis of big gathering events, such as sports and concerts. We cluster the urban area based on the similarity of their pick-up counts to find a meaningful grouping of locations. Clustering them can be helpful because the results show that places in the same cluster have similar patterns of demand. We face the challenge that measuring the similarity of pickup counts in time series is non-trivial and the absolute value of the measured distance is not informative in terms of how similar the time series are. We developed the algorithm that builds a similarity matrix of all locations, based on normalized Dynamic Time Warping with similarity measures for all pairs of locations. Also, we developed algorithms using spectral clustering to cluster urban area based on pick-up time series. The results provide a meaningful grouping of locations because we can see that busy locations belong to the same clusters and other quiet locations belong to different clusters. Also, locations next to each other, are clustered together, because they tend to have similar patterns.

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)

Affect of CKD on Neurocognitive Function

The purpose of this study was to further investigate the link between neurocognitive functioning and mild to moderate CKD. Maternal education, prematurity, and socioeconomic variables were considered to identify if they affected neurocognitive functioning. Iohexol-based GFR (iGFR) was measured and recorded, along with a series of intelligence tests and MRI imaging. Similar to previous studies, children with mild to moderate CKD preform have a slight decrease in neurocognitive function.

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 the etiology of sudden unexpected death in epilepsy (SUDEP) 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 correlation 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 REM sleep causes increased tonic phases and decreased seizure thresholds, both of which are well-documented risk factors of SUDEP. This is because brain monoamines, which protect against seizure-induced death, turnover more frequently, leaving the body more vulnerable. Additionally, bodily functions, like cardiac and respiratory function, operate more irregularly after sleep deprivation, increasing the amount of carbon dioxide in the blood and the brain; increased carbon monoxide 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. Outcome

measures are mortality, plethysmography, and brain function. 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)

Identifying Mechanisms Coupling Cell Metabolism to Force Transmission

All cells experience a variety of forces, such as stretching, tension and compression, throughout their lifetimes. These forces are sensed by E-cadherin, the primary epithelial cell-to-cell adhesion receptor. In response to force, E-cadherin initiates a signal cascade that culminates in elevated actomyosin contractility, retention of the glucose transporter GLUT1 at the plasma membrane, increased glucose uptake, and heightened ATP production. My project focuses on identifying how the glucose that is taken up in response to force is coordinated with E-cadherin. I hypothesize that in response to force, ankyrin-G, a spectrin adaptor protein, retains GLUT1 by physically anchoring this transporter to E-cadherin. To test this possibility, I stably inhibited ankyrin-G expression in epithelial cells. In the absence of ankyrin-G, cells cannot uptake glucose or stimulate downstream signal transduction cascades leading to increased contractility. Additionally, I present evidence that in the absence of ankyrin-G, GLUT1 is not retained at the plasma membrane and does not physically associate with E-cadherin. Taken together, these data indicate that ankyrin-G couples E-cadherin to energy metabolism.

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). These radio galaxies allow us to understand the formation and evolution of galaxies and can be used as tracers of the cosmic environment, to probe invisible gas in the universe, to detect galaxy clusters, and further address unresolved cosmological questions. Due to the size of these new surveys, the key benefit of applying this technique is to automatically detect and label stars, galaxies, cosmic rays, 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 the model using images identified by hand. Our model achieved an overall accuracy of greater than 70% for compact, diffuse, and FR II galaxies respectively.

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, myocardial infarction, or cardiac arrhythmias. Our lab identified a family with premature ventricular contractions, cardiac fibrosis, and bicuspid aortic valve. Clinical genetic testing failed to identify mutations or variants of uncertain significance in genes causative for SCD. Whole exome sequencing was performed on 4 affected members from this family to identify a genetic variant which caused this disease. We identified an ultra-rare variant in *MSX1*, *MSX1*-E135D, which cosegregated with disease in this family. *MSX1* is a homeobox protein which participates in cardiac development. We hypothesized that *MSX1* contributed to cardiac disease in this family, and sought to understand the role of *MSX1* in cardiac function. We generated a mouse with cardiac-specific deletion of *Msx1*. Electrocardiograms and echocardiograms were performed on *Msx1*-deficient mice. RNA-sequencing was performed to understand the impact of the loss of this transcription factor in the heart. Our data suggests *MSX1* may contribute to

this family's disease. Mice lacking *Msx1* demonstrated junctional arrhythmias and sinus node dysfunction. 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 lie a series of linear non-thermal filaments that are visible at radio wavelengths. We have observed the brightest and most dramatic filaments in the Galactic Center known as the Radio Arc in two separate frequency bands (centered at 6 and 10 GHz) 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. The presence of polarized intensity along these filaments helps to reveal the structure of the magnetic field. Our images of the polarized intensity show that there is an uneven distribution of polarization, where we then identify the main regions of concentrated polarization. We also identify the frequency dependence of the polarization across the two frequency bands and identify the primary method depolarization. We can use the information to extrapolate the intrinsic magnetic field of the Radio Arc. Finally, we identify regions where an external 'helical structure' could be interacting with and possibly depolarizing the linear filaments.

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)

Large Cumulative Differences in Lifestyle Physical Activity Estimates Result from Combinations of Actimetry Analysis Methods

Objective measures of physical activity (PA) have growing applications in personal recreation and preventative/rehabilitative medicine. While devices such as the Nike Fuel Band and Fitbit serve the general public, researchers rely on clinical-grade accelerometers and software platforms like ActiGraph to quantify PA. Despite technological advances, converting raw accelerations to useful measures of step counts, energy expenditure (EE) and time spent in moderate-to-vigorous-activity (MVPA) remains problematic; the cumulative effects of data-filters and algorithms within Actigraph are not well understood. Thus, the purpose of this study was to quantify the influence of analysis methods on PA metrics. Data from 134 participants wearing an ActiGraph-GT3X wrist-accelerometer (one week) was analyzed using exhaustive combinations of ten algorithms, the low-frequency-extension (LFE), and the wrist-correction. Large variations in PA estimates between methods were observed for EE ($\leq 83\%$) and MVPA ($\leq 100\%$) without effecting step counts. The LFE only notably impacted step outputs ($\leq 40\%$), whereas wrist options influenced MVPA ($\leq 100\%$) and EE ($\leq 44\%$) estimates. Though previously validated, methods are interdependent and noninterchangeable. Larger cumulative effects likely exist considering additional hardware and software variables. Exact measures of PA are highly dependent on analysis specifications, emphasizing a need for scoring/documentation standardization in clinical practice.

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 naturally occurring monoglyceride commonly used as an antimicrobial agent in many bacteria, fungi, and viruses. This compound has also been found to have immunosuppressive effects. These effects have been primarily observed in human T cells where GML alters the signaling events associated with metabolism and T cell activation. However, the effects of GML on other cells has not been tested. This project has examined if GML has similar inhibitory effects in human B cells. While B cells have different mechanisms that allow for activation, GML prevents B cell activation in a similar fashion observed in T cells. Through the testing of the GML/ B cell interaction aspects of signaling such as cytokine production, BLNK productivity, and CD19 productivity have been observed through TIRF microscopy and Western Blot data.

108. Marija Pritchard

Majors: Religion Studies, Biology

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

The Jewish, Mormon, and Oneida Communities' View of the Connecting Power of the Telegraph in the Middle and Late 1800's

The Jewish, Mormon, and Oneida communities were religious minorities in the United States in the 1800s. These groups along with mainstream American society showed a surprising interest in the electric telegraph, despite the fact that the telegraph was originally intended for business and governmental communication. This interest is evident in religious newspapers published by the Jewish, Mormon, and Oneida communities. These historical newspapers reveal that these groups saw the telegraph as an important avenue to connect and unify the members of their community and the world as a whole. Some of the members of these religious groups went so far as to equate the telegraph with the divine will of God. Connection was especially important for the continuation of minority groups because it allowed them to persist among mainstream Protestant denominations at the time. These religious communities' views of the telegraph provide us with important case studies that afford insight into how the telegraph and religion were entangled with each other in the nineteenth century.

110. Pravda Quinones

Major: Human Physiology

Mentor: Barry London (Internal Medicine)

The In Vivo Effects of NAD+ Supplementation on Cardiac Electrophysiology

Background: Boosting NAD⁺ content in the heart with NAD⁺ precursors is an emerging strategy for the prevention and treatment of cardiovascular diseases. Recently, our group has shown that the bioavailable NAD⁺ precursor

Nicotinamide Riboside (NR) modulates the main cardiac sodium channel Nav1.5 in cultured cells. However, the effects of NAD⁺ precursors on the electrical activity of the heart is unexplored.

Objective: To investigate the in vivo effects of NAD⁺ precursor NR on cardiac electrophysiology.

Methods: 4-5 month-old C57BL/6 mice were randomly placed on either a control diet or diet supplemented with NR (1%: 10g NR per 1 kg chow) for 12 weeks. Body weights were assessed every two weeks. Electrocardiograms and echocardiograms were performed at baseline, 6 weeks, and 12 weeks post-diet.

Results: NR had no effect on body weight over the 12-week time course, indicating the diet was tolerated. In addition, NR had no effect on cardiac function as assessed by echocardiogram. Interestingly, NR-fed mice had a reduction in QRS duration at 6 weeks and a reduction in QTc at 12 weeks compared to control mice, consistent with previous cellular findings.

Conclusion: Supplementation of NR modulates cardiac electrophysiology, warranting further investigation of NR as a therapy for arrhythmic disorders.

112. Theo Romac

Major: Biomedical Engineering

Mentor: E. Dale Abel (Internal Medicine)

Over Expression of Transcription Factor EB (TFEB) Targeted Gene Induces Autophagy and Leads to Heart Failure

Autophagy is an evolutionarily conserved ubiquitous mechanism that degrades and recycles cellular waste. Impaired autophagic flux has been observed in several cardiovascular pathologies, including hypertension and heart failure. Transcription factor EB (TFEB) plays a pivotal role in the regulation of autophagy and lysosomal biogenesis. This study sought to determine if TFEB overexpression would lead to an increase in autophagic flux and heart failure. We generated an inducible TFEB overexpression mouse using a Tet OFF system by removing doxycycline chow for two weeks at 10 weeks of age. Mice harboring both transgenes (TFEB and tTA) exhibited an increase in TFEB protein expression and mRNA. An increase in markers of pathological hypertrophy were observed by qPCR (nppa, nppb and acta1), as well as increased heart weight to tibia length (2.5-fold). TFEB overexpression resulted in impaired cardiac function as evidenced by reduced ejection fraction and increased end systolic volume. Despite PGC1 α being a direct target of TFEB, we reported no change in mitochondrial respiration. We observed an upregulation of t-ULK1 and p-ULK1, which is an indication of increased autophagy initiation, coupled to an increase in Lamp1 and mcoln1 mRNA. The overexpression of TFEB also resulted in an increase in t-mTOR, p-mTOR, S6, and p-S6 ribosomal proteins. Conclusion: Cardiac specific TFEB overexpression results in cardiac hypertrophy and heart failure possibly due to increased autophagy.

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, differentiate, and classify the objects in their surroundings. Many objects include two types of features: deterministic and probabilistic. Deterministic features are those that are always present within the stimuli of a certain category, whereas probabilistic features are likely to be present but may not be. Here, we aimed to see if pigeons' attention can focus on a deterministic feature (as adults do, because they have a mature prefrontal cortex) or if their attention tends to be more diffuse (as young children's is, because they lack a mature prefrontal cortex), depending on prior experience. Three groups of pigeons were pretrained with categories exemplars containing either only one deterministic feature, multiple probabilistic features, or both types of features. These differences in pretraining affected pigeon's later learning and attention. Those pigeons trained with the deterministic feature first were more likely to use the deterministic feature with novel stimuli, whereas those trained with the probabilistic feature first were more likely to use the probabilistic features with novel stimuli. These results are similar to those found in young 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)

Television Media Coverage and Voter Turnout: Evidence From 2018 Iowa Congressional Races

I estimate the impact of relevant television media coverage of a congressional race on voter turnout. I exploit exogenous variation in levels of coverage around the borders of Designated Marketing Areas. In particular, I compare voter turnout in precincts that fall in the same congressional districts but different media markets, and thus are exposed to different television media leading up to election day. I find a substantial positive impact of relevant political coverage equal to 4.7 percentage points of additional voter turnout. I suggest possible causes for this effect, including news coverage and advertising effects, and consider the limitations of my results. I also propose how my methodology may be adapted to answer questions about media bias and election outcomes.

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: Treatment of infected or inflamed endodontic tissues requires chemo-mechanical debridement of canal spaces, unfortunately, infections can reoccur. In this study, I assess the killing capabilities of a novel 265 nm LED

light source inside a representative tooth model on a variety of oral bacterial organisms that are associated with reinfection. Methods: Four bacterial cultures, *E. faecalis*, *C. albicans*, *S. aureus*, and MRSA #7 were used as separate testing organisms. One bacteria strain was put into two extracted, sterile tooth canals, one treated with water (control) and the other treated with LED light (265 nm). Canals were rinsed and treatments were spotted onto blood agar. At 24 hours, colonies were counted. Methods were repeated for each bacteria. Results: *E. faecalis*, *C. albicans*, *S. aureus*, and MRSA #7 all remained viable in control treatments (37.5+2.7, 9.0+1, 151.3+2.3, 139.3+7.2 SEM CFU, $p < 0.05$). The treatments with 265 nm LED produced significantly fewer CFU for all four bacteria (4.2+2.7, 1.8+1, 4.0+2.3, 0+7.2 SEM CFU, $p < 0.05$). Conclusion: The 265 nm LED light used inside the tooth model is able to significantly kill many resistant microorganisms and results indicate that it could be used as an adjunct for current root canal procedures.

126. Jacob Tinker

Major: Exercise Science

Mentor: Terry Wahls (Internal Medicine)

Baseline Statistics 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)

Variations in Solar Minima Analyzed Using Radio Flux Measurements

Considerable interest lies in studying long-term variations in solar activity. It is easiest to detect these variations during periods of low solar activity, or solar minimum. Previously, sunspot number has been the most common parameter to measure the magnitude of these variations. However, sunspot numbers are

susceptible to a relatively high amount of subjectivity. A completely quantitative and objective measure of solar activity is provided by 10.7 cm radio flux measurements that have been made by the Canadian National Research Council since 1947. We have been using this data to analyze the distribution of radio flux values at times around the solar minima that occur during 2007 and 2018. Our goal has been to determine the minimum flux value and probability distribution function of fluxes at these times. Currently, our analysis has shown that both the minimum flux values and probability distribution functions were very similar for these two minima. Future analysis will consist of applying our techniques to earlier, more active minima, which will let us determine an overall trend in long-term solar variation.

130. Henry Wang

Major: Neuroscience

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

MRAP2 dissociate MC4R-mediated sympathetic control of metabolism and blood pressure

The melanocortin-4 receptor (MC4R) plays an important role in the control of food and energy expenditure by increasing thermogenic sympathetic nerve activity (SNA). The melanocortin receptor protein MRAP2 regulates the activity of the MC4R and other G-proteins, but its role in MC4R-containing neurons is not clear. We hypothesized that MRAP2 in MC4R neurons is essential for the regulation of SNA, energy homeostasis, and blood pressure. We generated mice lacking MRAP2 in MC4R neurons by crossing MRAP2^{fl/fl} mice with MC4RCre mice. The MRAP2^{MC4R} mice displayed obesity. Weights of fat pads and liver were also elevated in the MRAP2^{MC4R}. Glucose and insulin tolerance tests revealed impaired glucose tolerance and insulin-induced glucose clearance in MRAP2^{MC4R} mice compared to controls. Baseline brown adipose tissue SNA tended to be lower in MRAP2^{MC4R} mice relative to controls. Moreover, intracerebroventricular injection of MTII increased SNA in control mice but not in MRAP2^{MC4R} mice. On the other hand, the MTII increased in renal SNA and blood pressure was indifferent in MRAP2^{MC4R} mice relative to controls. These findings support a role for MRAP2 in uncoupling neuronal MC4R-mediated control of sympathetic traffic impacting energy and blood pressure.

132. Yihang Wang

Majors: Economics, Mathematics

Mentors: Hyeong0Tak 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

This paper will explore the influence of different dimensions of cultural distance among countries on the transmission of cultural products, and the effects of cultural transmissions on consuming behaviors in other merchandises of target countries, further influencing export trade. I select Korean popular music as the research object. I'll choose and investigate

several worldwide music charts, for example, YouTube, iTunes, and Spotify, and collect data mainly from three aspects which are streams, artists, and songs, then create a popularity index to evaluate the level of K-pop popularity in each country. I use Hofstede's cultural dimension theory to measure cultural distance in different countries, then do regression (popularity index and cultural dimensions) to figure out which of these six cultural dimensions would impact on cultural transmission. After that, I choose ten countries which have a relative higher popularity index, comparing their monthly popularity index with South Korean's export amount by USD of different products, to find out what products' export might be influenced by cultural transmission.

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 female acquaintances 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. 440 undergraduate males indicated how often they had used each PBS in the last year on each of the measures, and they also completed a measure 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, endorsement of rape-supportive attitudes correlated negatively with PBS usage to reduce sexual aggression and more weakly with PBS usage to reduce risky sexual behavior. These findings suggest that 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; (b) solicit feedback from college men on the wording and appropriateness of items; and (c) determine if PBS usage across aggression, risky sex, and heavy drinking domains is interrelated.

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 cardiovascular disorder that affects 4-7% of pregnancies and typically involves onset of hypertension, proteinuria, and edema. Diagnosis is formally performed in the second half of gestation upon clinical signs, but we and others have discovered plasma copeptin (CPP, a biomarker for arginine vasopressin, AVP, secretion) is elevated in the first trimester and highly predictive in development of PE. Our objective is therefore to understand the cause of elevated AVP/CPP secretion in human PE. We hypothesized that plasma AVP itself is elevated in early gestation of pregnancies that later develop PE, and that elevated AVP/CPP secretion during PE is secondary to altered volume regulation. Blood samples from clinically-matched pregnancies were obtained from the Maternal Fetal Tissue Bank (IRB#200910784) at the University of Iowa. Plasma levels of AVP were increased in 1st and 2nd trimester from women who later developed PE,

despite no change in osmolality. Plasma sodium was increased in 1st and 2nd trimesters before onset of PE, but potassium was unchanged. Results support the conclusions that maternal plasma AVP itself is increased in early pregnancy before the onset of clinical symptoms of PE, and that the defended osmolality set-point is similar between control and PE pregnancies.

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).

