

The 9th Annual



Fall

Undergraduate

Research

Festival

Wednesday, November 14, 2018
4:30pm-6:30pm

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

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

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

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

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

**www.uiowa.edu/icru
319.335.8336
icru@uiowa.edu**

The 2018 Fall Undergraduate Research Festival (FURF) is proud to showcase visual presentations focusing on the research and creative work performed by undergraduates at the University of Iowa. Presenters work in over **35 different departments**, representing a broad range of sciences, arts, and humanities.

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

*****Please note that at 5:30, all of the boards will be turned around to show the even numbering and the second hour presenters' posters*****

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

Programs with full abstracts are available on the ICRU website.

Upcoming ICRU Events and Opportunities

- Excellence in Undergraduate Research Award - February 8, 2019
- Distinguished Mentor Award - February 8, 2019
- ICRU Research Fellowship Applications Due:
 - *Summer - March 1, 2019
 - *Academic Year - March 29, 2019
- Research in the Capitol - April 1, 2019
- Spring Undergraduate Research Festival (SURF) - April 17, 2019

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

1 - Benjamin Allington

Major: Biochemistry

Mentor: Marcelo Correia (Internal Medicine)

Skeletal muscle-specific DRP1 deficiency is associated with attenuated high fat diet-induced weight and adiposity gain, improved glucose tolerance, augmented energy expenditure, and elevated expression of FGF21

Background: Skeletal muscle of type 2 diabetics exhibit mitochondrial dysfunction associated with increased mitochondrial fragmentation suggesting that inhibition of DRP1, a protein required for mitochondrial fission, might be explored therapeutically. We studied the impact of muscle-specific DRP1 deficiency on metabolism.

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 protein expression was reduced by 40% in skeletal muscle of homozygous floxed male mice expressing CRE (KO mice). KO mice were resistant to weight and adiposity gain during 10 weeks of high fat diet. KO mice exhibited improved glucose tolerance. Data from metabolic cages showed that energy expenditure was increased in KO mice. Expression of FGF21 mRNA is substantially elevated in KO mice.

Conclusions: Skeletal muscle-specific DRP1 deficiency attenuates glucose intolerance and reduces weight and adiposity gain during high fat diet, which could be associated with increased metabolic rate. Increases in FGF21 and other myokines could help explain the metabolic effects in DRP1-deficient mice.

3 -Maeve Bittle

Major: Environmental Engineering

Mentor: Rachel Marek (Civil and Environmental Engineering)

Evidence of construction and environmental sources in air of urban homes near PCB-contaminated waterway pre- and post-dredging

This project will determine airborne concentrations of persistent, toxic polychlorinated biphenyls (PCBs) inside and outside homes in urban East Chicago, Indiana. These homes are located near a PCB-contaminated waterway, the Indiana Harbor and Ship Canal (IHSC), which is currently being dredged by the Army Corps of Engineers. Other possible sources of PCBs to home air include modern pigments present in house paint and historical Aroclor mixtures of PCBs such as what is found in some old window caulking and light ballasts. Air samples were previously collected by field staff using polyurethane foam passive air samplers (PUF-PAS) before and after dredging started. The specific hypotheses to be addressed by this project are: 1. The effect of IHSC dredging can be detected and measured at the participating East Chicago homes using PUF-PAS. 2. PCB sources can be identified inside East Chicago homes. Thirty samples collected before dredging started were previously analyzed. Extraction efficiency, reproducibility, and accuracy was assessed using ^{13}C labeled surrogate standards and replicates of method blanks. Although one larger scope of this project is to compare pre- and post-dredging samples, this poster highlights the 24 of 60 post-dredging samples analyzed this summer.

5 - Glorie Borsay

Major: Global Health Studies

Mentors: Brinda Shetty (Biology), Kelly Baker (Occupational and Environmental Health)

Understanding Pathogen Persistence in soil through a Terrarium Experiment

Though there are numerous studies measuring the length of time pathogens persist in wastewater environments; pathogen persistence in soil of tropical environments is relatively poorly understood. To better understand pathogen persistence in soil, we have created a terrarium that mimics a tropical environment. Soil from Kenya will be used in this experiment, as well as Enterotoxigenic Escherichia coli (ETEC) since it is a common water and soilborne pathogen that causes disease. To better understand how pathogen survives in the soil, we will spike a known amount of live ETEC, inactivated ETEC, and DNA into separate beakers of soil in the terrarium. Then we will sample the soil from those beakers over time. Separate beakers will be used for each sampling point and each designation of ETEC. We will then perform quantitative PCR which allows us to see how much soil survived over time. Eventually, we will repeat this experiment with dangerous pathogens like shigella. This novel experiment will help narrow the gap in research regarding

pathogen persistence in soil over time. The results from this experiment can help develop knowledge around understanding pathogen persistence in soil, which is critical for improving public health research.

7 - Claire Carmichael

Major: Biology

Mentor: Jamie Soto (Internal Medicine)

The Effects of Transverse Aortic Banding on Cardiac Hypertrophy

Transverse aortic constriction (TAC) surgery induces cardiac hypertrophy in a mouse model. The main purpose of this study was to establish a TAC/de-TAC produce. Once established we will use the method to test how certain genetic modifications may protect or exacerbate cardiac damage caused by pressure overload. The mice in this experiment were split into groups and studied over a four-week period. The mice that underwent TAC surgery had their descending thoracic aorta ligated (sham group underwent everything except the actual ligation). In one group, TAC lasted four weeks, and the mice developed significantly enlarged hearts by weight from the control (sham) mice. In another group, mice underwent TAC surgery and then after two weeks had the ligation of the aorta removed for another two weeks. These mice did not have significantly different heart weights compared to the control mice. Measurements regarding cardiac function by echocardiogram were not significantly different after four weeks. We can conclude that this timeline is sufficient to study cardiac hypertrophy but not the effect on cardiac function.

9 - Kevin Chen

Major: Human Physiology

Mentor: Eric Devor (Obstetrics and Gynecology)

Reduced Renal Response to Vasopressin in preeclampsia

Preeclampsia (PE) is a dangerous cardiovascular disorder of pregnancy with an onslaught of clinical symptoms. We have determined that PE is linked to an increased secretion of the hormone arginine vasopressin (AVP) in the mother's blood. We have also demonstrated in lab that injecting mice with AVP will give the mice PE symptoms. Due to technical challenges measuring AVP, we used copeptin (CPP), a hormone closely linked to AVP, as a marker to AVP secretion. How and why AVP secretion is increased is unknown. Because we found that blood concentration is normal in participants with PE, we hypothesize that there is an increased in AVP secretion during PE because the kidney is desensitized to AVP. To test our hypothesis, we collected urine sample from 40 PE patients and 40

controls from the University of Iowa Maternal-Fetal Tissue Bank. We then quantify the participant's CPP and Aquaporin level in their urine. Aquaporin facilitates water retention in the kidney. As expected, we found a relevant increase in CPP in PE patients, while AQP2 levels were similar in both groups. These findings support the hypothesis that elevated AVP secretion during PE is due to reduced kidney sensitivity to it.

11 - Akanksha Chilukuri

Majors: Neuroscience, Biochemistry

Mentor: Hanna Stevens (Psychiatry)

Effects of Preeclampsia on Cortical Growth and Cortical-Dependent Behavior Using a Vasopressin Mouse Model

Preeclampsia, a gestational disorder characterized by hypertension, proteinuria, and intrauterine growth restriction affects about 5 to 10% of pregnancies and is associated with various pregnancy complications and an increased risk of neurodevelopmental disorders in offspring. To model preeclampsia in mice, we insert a subcutaneous pump that continuously releases vasopressin (AVP), a hormone that is elevated in human preeclampsia and is sufficient to cause the clinically relevant phenotypes of preeclampsia, throughout gestation, into female mice three days before mating. Results indicate that offspring born to AVP-treated dams at several time points, we found that adult females exhibit learning and memory deficits, while males display anxiety-like behavior and hypersociability. Immunohistochemistry results have shown there was a decreased cortical volume in AVP mice at E18, P0, and P7 but not in adults. In addition, we have found that the cell number remains the same at E18 but that density is increased to accommodate for the volume differences. Currently, we are using Neurotrace, a fluorescent Nissl dye that stains for neurons, to gain a better understand of what the percent of neurons to neurites to cell soma are in various cortical layers.

13 - Greg Collins

Major: Human Physiology

Mentors: E. Dale Abel (Internal Medicine), Helena Kenny (Internal Medicine)

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

The optic atrophy 1 (OPA1), mitochondrial dynamin-like GTPase, regulates mitochondrial inner membrane fusion. Reduced myocardial

OPA1 protein expression has been reported in humans and animal models of heart failure. The present study sought to determine whether OPA1 deficiency would cause mitochondrial dysfunction, heart failure and death. Inducible cardiac-specific OPA1 knockout (KO) mice were generated by administering tamoxifen to mice harboring OPA1^{flox/flox} and $\hat{I}\pm$ MHC-MerCreMer for 5 days at 7 weeks of age (2.5 mg/kg). OPA1 was significantly decreased 4 weeks after tamoxifen injection, and female mice with OPA1 KO had reduced ejection fraction at 10 weeks and at 12 weeks in males. Mice started to die 15 weeks after tamoxifen injection. Transmission electron microscopy revealed an increase in mitochondrial number and circularity index and a reduction aspect ratio together with a reduction in cristae number, volume and area ($p < 0.05$) 8 weeks post tamoxifen. Citrate synthase activity (-38%) and pyruvate/ADP driven mitochondrial respiration (-26%) was reduced after 8 weeks ($p < 0.05$). However, palmitoyl carnitine supported respirations and mitochondrial electron transport chain protein content was unchanged. OPA1 deficiency resulted in an increase in ER stress after 4 weeks. Loss of OPA1 leads to heart failure and premature death in both male and female mice. The earliest defect is ER stress that precedes mitochondrial fragmentation and subsequent ventricular dysfunction.

15 - Brandon Cooley

Major: Biology

Mentors: Donna Santillan (Obstetrics and Gynecology), Eric Devor (Obstetrics and Gynecology)

The Effects of Aspirin on Gene Expression in Human Placental Tissues

Preeclampsia is a hypertensive disorder of pregnancy. It is the highest cause of maternal morbidity and mortality in pregnancy. The only preventative treatment is aspirin (81mg/day). To better understand the mechanism by which aspirin prevents preeclampsia, we treated trophoblast cell lines with 2mM aspirin as well as HTR8sv/neo cell lines with 2 mM of aspirin as well as analyzing gene expression differences of 84 cardiovascular genes between placental tissues from 4 different cohorts: Preeclamptic women, preeclamptic women who took aspirin during pregnancy, non-preeclamptic women, and non-preeclamptic women who took aspirin. The placental tissues were obtained from the Maternal Fetal Tissue Bank at the University of Iowa. We dedicated significant differences in gene expression with aspirin and between the cohorts. Overall, gene expression was increased in women with preeclampsia and differences were reduced with the addition of aspirin. These results will help us better understand the pathways involved in the prevention of preeclampsia.

17 - Jacquelyn Danover

Major: Accounting

Mentor: Samuel Melessa (Accounting)

Information Overload in Annual 10k Financial Reporting: FASB Disclosure Framework and Its Effect on 10k Length and Investor Perceptions

Through my research, I examine the FASB disclosure framework and SEC financial statement reporting requirements which have impacted the length of the 10k financial statements. Additionally, I consider the diverse types of investors and their range of needs for information within the financial statements. While exploring disclosure requirements and investor needs, I will discuss the notion of information overload and its impact on investors' investment perceptions or willingness to invest in certain companies. Research presented indicates potential causes or additional elements that add to the information overload problem within 10K annual filings, and I further consider the positive and negative impacts of too much or too little information for investors. Over the years, specifically since the last financial crisis in 2008, annual disclosure requirements have become increasingly stricter under FASB and GAAP standards, which has thus resulted in extensive information reporting in the annual 10K financial statement filings. Now, FASB and the SEC are grappling with potential changes to the disclosure framework in order to better provide only necessary and useful information to investors.

19 - Lauren Davis

Major: Human Physiology

Mentor: Donna Santillan (Obstetrics and Gynecology)

Effects of Hypertensive Disorders Related to Pregnancy on the Expression of Arginine Vasopressin Receptors

Arginine vasopressin (AVP) is a hormone that functions to regulate blood pressure. The three main receptors are AVPR1a, AVPR1b, and AVPR2 which were further investigated in this project as well as with OXTR, LNPEP, and CUL5. AVPR1a functions in the smooth muscle and causes vasoconstriction, AVPR1b functions in the pituitary helping to regulate adrenocorticotrophic hormone release, and AVPR2 is expressed highly in the kidneys and works to concentrate urine. In a previous study, we investigated whether receptor expression was affected by different pregnancy-related factors such as sex of the baby and gestational age at delivery (term vs preterm delivery). We have now investigated the effects of maternal chronic hypertension and preeclampsia on vasopressin

receptor expression in umbilical cord blood. Umbilical cord blood cell pellets (N=30) were obtained from the Maternal Fetal Tissue Bank. RNA was extracted and used to generate cDNA for qualitative PCR to determine if there are any variations in receptor expression compared to control subjects. In children born to women with chronic hypertension, AVPR2 (-8.2 Fold Change), LNPEP (-13 Fold Change), CUL5 (-14 Fold Change) AVPR1b (-3.1 Fold Change) and OXTR (-4.3 Fold Change) receptors were all expressed significantly lower. The preeclampsia samples had significantly lower expression of AVPR1a (-4.7 Fold Change), AVPR1b (-2.5 Fold Change), AVPR2 (-2.5 Fold Change), and OXTR (-2.8 Fold Change) when compared to nonpreeclamptic samples.

21 - Jonathan Dolde

Majors: Physics, Applied Physics, Computer Science

Making Sense of System Logs: Implementing centralized system log storing, indexing, querying, and visualizing software on a heterogeneous network

The Relativistic Heavy Ion Collider (RHIC) and A Toroidal Large Hadron Collider (LHC) Apparatus (ATLAS) Computing Facility (RACF) at Brookhaven National Laboratory is responsible for the computing power of many high energy physics experiments. The system logs of all the machines at the RACF contain excellent diagnostic information. My work was to parse system logs adhering to the syslog protocol through the Elastic Stack, providing a seamless way to collect, parse, store, and query these logs. I installed and configured the software through Puppet. By modifying Puppet modules and writing YAML files, each application in the Elastic Stack can be constructed to meet the specific needs of the RACF. The final configuration for the production Elastic Stack was a direct, encrypted connection to Logstash, which used grok pattern matching to send indexed information to our Elasticsearch cluster, consisting of 3 data nodes, with 4 TB of storage each. This allows for approximately one month of rolling syslog message storage (with one redundant copy for each message shard). Finally, we hosted the Kibana web GUI locally such that currently only system administrators have access to the digested syslog messages.

23 - Julianna Feracota

Majors: Accounting, Dance

Mentor: Cristi Gleason (Accounting)

ASC 606: Impacts on Revenue Disclosure

In May of 2014, FASB issued ASC 606: Revenue from Contracts with Customers, revising the former revenue recognition standard. This new standard became effective after December 15, 2017 for all public companies. ASC 606 substantially alters disclosure requirements and ensures that revenue recognized from contracts with customers reflects the amount of money expected to be received from those contracts. With the new standard comes increased requirements for disclosures. New disclosures are expected to be longer and include a greater break down of revenue information.

My research focuses on the new disclosure requirements and has led me to the following questions: How have the changes in disclosures differed between 2017 and 2018 for public companies? Are there major differences between large public accounting firms, like PWC and Deloitte? Will these changes cause an inconsistency in user's understanding of revenue depending on the auditing firm used? Have the new disclosures made financial analysts more accurate in their predictions for the year?

The considerations above are important because they will impact how users of financial information make decisions about firms. More detailed information about revenue will likely alter a person's perception of the firm and can impact analysts' earning estimates earlier in the fiscal year.

25 - Yuwei Guo

Major: Biochemistry

Mentor: Huojun Cao (Endodontics)

Activation of endogenous BMP2 in human cell by CRISPR-Cas9 SAM based synthetic transcription factor technology

The objective of this experiment is to determine whether CRISPR-Cas9 SAM based synthetic transcription factor technology can be used to active endogenous BMP2 in human cell. BMP2 is the only kind of protein approved for bone regeneration. However, because of its short half-life, excessive amount of protein has to be applied to be achieve therapeutic effects. Therefor this will exert major side effects. This experiment is to determine whether CRISPR-Cas9 SAM based synthetic transcription factor technology could active the expression of endogenous BMP2. This experinment uses Opti-MEM|Reduced-Serum Medium was added into both dilute DNA plasmids and dilute polyethylenimine. The DNA plasmids mixture contain sgRNA plasmids, which were loaded with

single or different combination doses. The mixture was added to human 293T cells and incubated for 48 hours. The transfection results were evaluated by using microscope observation of EGFP. RNA was extracted and used to create complementary DNA. Gene expression of BMP2 was qualitatively by Real Time PCR. As a result, all of three single sgRNA and combinations of sgRNA active the BMP2 in human 293 T cell. CRISPR-Cas9 SAM based synthetic transcription factor technology can active endogenous BMP2 in human 293T cells. In the future this technology might be useful to reduce side effects caused by excessive amount of BMP2 protein.

27 - Morgan Hardiman

Major: Business Analytics and Information Systems
Mentor: Jeffrey Ohlmann (Management Sciences)

Analysis of Primetime National Football League Viewership Ratings

We conduct an analysis on the viewership ratings for the three primetime National League Football games throughout the week (Monday, Thursday, and Sunday) of a regular season from 1993 to 2016. We have analyzed that over time there have been increases and decreases in the viewership ratings over the last two decades, so we began to dig deeper into what causes the variation in ratings. First, we will create a descriptive regression model for each specific night based on factors that will produce variation in the viewership, which will explain over 90% of the variability. We will look at how the z-scores of the viewership rating for each night and each network are distributed throughout the time period. A classification model from a Bayesian logistic regression will also provide an estimate of which games maximize their viewership and, in opposition, which games should not be given the primetime television spot based on the statistically significant factors.

29 - Cameron Hauser

Major: Human Physiology
Mentor: Gordon Buchanan (Neurology)

The involvement of the locus coeruleus in CO₂-induced arousal from sleep

CO₂-induced arousal from sleep is a vital protective mechanism that enables the sleeper to detect and wake up in response to potentially harmful increases in CO₂. Dysfunction in this mechanism may be involved in conditions such as sudden unexpected death in epilepsy and sudden infant death syndrome. Individuals affected by these conditions do not

arouse to hypercapnia during sleep resulting in acidosis and eventual death. Despite its importance, this mechanism is not fully understood. Identifying the brain areas responsible for this process may provide insight on the malfunctions occurring in these conditions. To test the involvement of the locus coeruleus, C57BL/6J mice were treated with DSP4 to destroy locus coeruleus noradrenergic neurons and exposed to 7% CO₂ during sleep. The latency of arousal to CO₂ was quantified. DSP4-treated mice displayed decreased responsiveness to CO₂, supporting the involvement of the locus coeruleus in CO₂-induced arousal. This finding increases our knowledge of the CO₂-induced arousal system and may be important in the prevention of sudden unexpected death in epilepsy and sudden infant death syndrome.

31 - Elise Heitmann

Major: Anthropology

Mentor: James Enloe (Anthropology)

Getting Nauti: The Necessity of Textual Evidence in Caribbean Underwater Archaeology

Text-aided archaeology has been widely utilized in many archaeological disciplines, but has yet to be taken advantage of in the field of underwater archaeology. The utilization of historical documents in underwater archaeological analysis, particularly in Caribbean colonial-era underwater archaeology, would allow historians and archaeologist to understand more about historical maritime culture and economy. The comparison of archaeological remains, historical and ancient texts, and art history allows researchers to develop clearer interpretations of the past. In the colonial era, European imperial governments kept ample records of trade and warfare; many of these records are currently preserved in archives in both the Americas and Europe. This thesis intends to explore the importance of the incorporation of historical documents in underwater Caribbean archaeological analysis.

33 - Olivia Kane

Majors: History, English

Mentor: Michael Moore (History)

Of Prophecy and Christianity: Thomas of Erildoune and the Intersection of Christianity and Magic in Medieval Scotland in Literature

This thesis examines the folk beliefs of Medieval Scottish society by exploring literature of the time. It moves beyond scholarship on the beliefs that are based on the writings of the Christian Church and argues

that Scottish folktales, ballads, and prophecies exhibit the clash and the blending of folk belief and the Christian Church in society. Specifically, the thesis focuses on the literature surrounding the famous figure of Thomas of Ercildoune, a nobleman from the thirteenth century that was a famous secular prophet. The thesis is using the romantic tale and ballad based on him, as well as his prophecies to explore these beliefs and how they mixed with Christianity. Some of the specific folk beliefs that this thesis is exploring are the beliefs surrounding faeries and prophecy. It is looking into what these beliefs were, how they were ingrained into society, and how the Christian Church tried to twist them to their own use. Beyond the pieces surrounding Thomas of Ercildoune a few other text that are used in conjunction to help showcase and explain these beliefs. These pieces are the tale of Tam Lin and the Arthurian legends.

35 - Khaled Kayali

Major: Biomedical Engineering

Mentor: Hanna Stevens (Psychiatry)

Effects of Cypermethrin and Stress on the Embryonic Brain

Prenatal exposure to alpha-cypermethrin is a risk factor for adverse neurodevelopmental outcomes in children. In addition, psychological stress in pregnant mothers causes changes to physiology and may influence end-stage cypermethrin toxicity to the fetus. As such, the present study examined effects of prenatal exposure to alpha-cypermethrin and maternal stress, alone and in combination, on embryonic neurodevelopment. CD1 mouse dams were administered alpha-cypermethrin (10mg/kg in corn oil) from embryonic day 11 to 14 (E11-E14). Half of all dams were subjected to restraint under bright light (3x45 min per day) E12-E13. Neurodevelopmental endpoints including microglia morphology and neural progenitor proliferation, apoptosis, and differentiation were assessed by qPCR and immunohistochemistry. Combined administration of cypermethrin and restraint stress significantly delayed the tangential migration of GABAergic progenitors into the cortical plate and increased the size of the ventral forebrain ventricular site of GABAergic neurogenesis. However, expression of stem cell, cell cycle, and cell death genes in ventral forebrain was unchanged by either treatment. Cypermethrin alone had no significant effect on the volume of Pax6-positive stem cells in the dorsal forebrain. These findings combined administration of maternal stress and cypermethrin exposure results in alterations of specific neurodevelopmental processes of GABAergic progenitor cells in the embryonic forebrain.

37 - Cory Rude

Majors: Physics, Astronomy

Mentors: Jane Nachtman (Physics and Astronomy), Yasar Onel (Physics and Astronomy)

Radiation hard scintillator research and development

A crucial component of scintillators in current and future collider experiments is their ability to operate after exposure to radiation. The University of Iowa HEP group is developing scintillators for use in both HEP and medical fields. This talk will focus on our progress so far.

39 - Yi Xuan Khoo

Majors: Informatics, Psychology

Mentor: Kyle Rector (Computer Science)

Virtual Showdown: An Accessible Virtual Reality Game with Scaffolds for Youth with Visual Impairments

Virtual Reality (VR) is a growing source of entertainment, but people who are visually impaired have not been effectively included. Audio cues are motivated as a complement to visuals, making experiences more immersive, but are not a primary cue. To address this, we implemented a VR game called Virtual Showdown. We based Virtual Showdown on an accessible real-world game called Showdown, where people use their hearing to locate and hit a ball against an opponent. Further, we developed Verbal and Verbal/Vibration Scaffolds to teach people how to play Virtual Showdown. We assessed the acceptability of Virtual Showdown and compared our scaffolds in an empirical study with 34 youth who are visually impaired. Thirty-three participants wanted to play Virtual Showdown again, and we learned that participants scored higher with the Verbal Scaffold or if they had prior Showdown experience. Our empirical findings inform the design of future accessible VR experiences.

41 - Lyndi Kiple

Major: Chemistry

Mentor: Heidi Lung (Anthropology)

Museums Matter: A Descriptive & Comparative Analysis of Iowa's Museums

Using responses from the 2017 Iowa Museum Survey conducted by the Iowa Museum Association, the research team developed a comparative analysis of Iowa's museums. The interpretation of the survey results

focused on governance type, budget, attendance, and employment. This descriptive analysis presents a foundation of understanding about the current state of museums in Iowa that previously did not exist. Analysis of these results also included comparisons with the 2017 National Salary Survey by the American Alliance of Museums. This comparative analysis showed how Iowa museums stand out from the rest of the country, including areas of excellence and places for improvement. Results have been shared with the field through presentations online and at the state museum conference, and are now being used by the Iowa Museum Association to inform strategic planning, monitor growth of Iowa's museums, and raise awareness about why Iowa's museums matter.

43 - Allison Kusick

Major: Geoscience

Mentor: David Peate (Earth and Environmental Sciences)

Searching for Datable Minerals in the Osborne Core Using Portable X-Ray Fluorescence Elemental Analyzer

The purpose of this research project is to determine the age of the Osborne Iowa anomaly. Similar gabbros have been mined from the Duluth, MN complex for their abundance in copper, nickel, and platinum group metals. The Osborne complex may be of the same age and value as Duluth's. A core was drilled in 1963 by the New Jersey Lead and Zinc Company and stored at the Iowa Geological Survey's rock repository. The 2,559 feet deep sample is broken into 159 boxes with roughly 10 feet in each box. pXRF analysis was used on one every two or three boxes. The horizons that are high in zirconium and thus potentially datable minerals were identified. Using the electron microprobe, backscatter imaging along with elemental analysis determined the sample was abundant in the Zr-containing minerals zirconolite and baddeleyite. These mineral inclusions are ideal for uranium-lead dating and will be prepped and sent to the USGS dating center in Denver to be assigned ages.

45 - Aishwarya Kothapalli

Major: Human Physiology

Mentors: Alina Dumitrescu (Ophthalmology), Arlene Drack (Ophthalmology)

Long-Term Outcomes of Patients with Anomalous Head Position Due to Nystagmus and Strabismus treated with a Modified Anderson-Kestenbaum Procedure

Introduction // Purpose

Nystagmus is a condition involving repetitive and uncontrolled movements of the eye. Some patients develop anomalous head position (AHP) to improve their vision. Some of them have concomitant strabismus. This study is evaluating long-term outcomes of patients surgically treated with a modified Anderson-Kestenbaum (AKP) procedure for AHP due to nystagmus and strabismus. The purpose was identifying variables that may lead to optimal postoperative results.

Methods

Retrospective chart review of patients surgically treated with extraocular muscle surgery. An optimal outcome was defined as complete correction of the AHP or AHP of 10 degrees or less at last follow up and no strabismus.

Results

49 patients met inclusion criteria. 55.10% patients achieved an optimal outcome, while 71.43% patients displayed some improvement in their anomalous head position. Only 34.69% patients had no AHP postoperatively. 24.49% of patients had no strabismus postoperatively. No single variable was identified to be correlated with optimal outcome.

Conclusion

Though the number of patients in this study was small, it shows that although general improvement after surgery is common, the likelihood that an optimal outcome will be achieved cannot be guaranteed. It is also likely that some degree of an AHP and/or strabismus will be present following surgery

47 - Kathryn Kuennen

Majors: Anthropology, Ancient Civilizations

Mentor: James Enloe (Anthropology)

Archaeological Little Barley: A Carbonization Experiment

Little barley grains in the archaeological record are often found carbonized and without their chaff. The chaff is the inedible casing surrounding the seed and it is highly unusual to find barley without its chaff in modern wild populations today. Researchers have argued that the overwhelming presence of little barley without its chaff in the archaeological record indicates that an ancient domesticated variety may have once existed. This domesticated, chaff-less variety of little barley would be ideal for easy harvesting and food processing. Others have speculated that the absence of chaff is the result of manual processing of wild populations through burning. In this experiment, we carbonized

modern wild little barley grains at 450Å° for three and six-hour increments to determine whether or not various parts of the chaff could be destroyed during carbonization. Our results show that carbonization does not remove the chaff of little barley grains.

49 - Sarah Lauer

Majors: History, Anthropology

Mentor: Michael Moore (History)

Honor and Shame in the Sagas of Icelanders: Women's Struggle for Influence during the Icelandic Commonwealth

This thesis explores the agency of women in Medieval Iceland through the examination of the Icelandic sagas. The Icelandic sagas are one of the most impressive bodies of literature to emerge from Medieval Europe. The sagas offer a trove of social information and a look into the society of Medieval Iceland. These narratives tell the story of the people of Iceland during the first 160 years of settlement, beginning in AD 870. While their focus is on the struggles of men, the sagas do not ignore women. In Medieval Iceland, women had no judiciary standing and relied on men for safety, status, and property. However, the sagas do not paint a picture of powerless women. The sagas show that women influenced situations by using the strict honor code of Iceland to their advantage. Because of men's concern with maintaining their honor, a woman could goad a man into action by shaming and threatening his honor and masculinity. Men would then commit acts that the women themselves were not allowed to commit. The purpose of this research is to explain the speech acts and the context of these situations, as well as argue that this behavior actually happened and was a way for Icelandic women to influence situations. This thesis looks at three instances when a woman employed this technique: when she felt humiliated or wronged, when she wanted to further her own interests, or when she wanted to avenge the death of a kinsmen.

51 - Anqi Li, Qing Lian

Majors: Finance; Accounting, Business Analytics and Information Systems

Mentor: Tong Yao (Finance)

Stock evaluation

We performed free cash flow valuation on selected companies – pairs of a Chinese company traded in a US stock exchange and a peer US company that is also publicly traded and in the same industry as the

Chinese company. After completing free cash flow valuation analysis on selected companies, we performed further statistical analysis to assess the relative valuation of the Chinese companies vs. the US peers, in an attempt to infer whether there are valuation differences, and we also further identify potential causes of such valuation differences – such as differences in investor base, quality of accounting statements and information disclosure, etc.

53 - Mary Li

Major: Neuroscience

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

Mutation in CTNNA2 gene Associated 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.

55 - Tianyi Li

Majors: Environmental Sciences

Mentors: Md. Robiul Islam (Chemistry), Betsy 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. PM₁₀ concentrations ranged 66-343 µg/m³ in Lumbini, 57-154 µg/m³ in Dhulikhel, 87-344 µg/m³ in Ratnapark, and 133-433 µg/m³ in Patan. 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.

57 - Yitong Li

Major: Computer Science

Mentors: Brandon Myers (Computer Science), Kyle Rector (Computer Science)

Accessible Tools for Students who are blind or low vision in Computer Science Learning

In computer science, students who are blind or low vision will encounter barriers during their learning period because many computer science tools are not accessible to them. The subfield of Computer Architecture, in particular, has few if any accessible software tools. Computer Architecture is the study of how to build computer processors, as well as interfaces between hardware and software. Education in Computer Architecture requires specialized software tools, where people write textual programs in some programming specific languages. Furthermore, the outputs of these interfaces are visual renditions of digital logic circuits. To address these problems, we are determining in what specific ways these software tools are not accessible and ways that we might make creating and interacting with schematics accessible.

59 - Joshua Larson

Majors: Physics, Electrical Engineering

Mentors: David Miles (Physics and Astronomy), Bob Merlino (Physics and Astronomy)

Sparking Passion for Plasma: Creating undergrad experiments to foster interest in plasma physics

Plasma physics is at the heart of how we study space, fabricate electronics, and strive towards fusion energy. The subject often sees little exposure in undergraduate curriculum however. When students do investigate the topic, it is mostly limited to textbooks and theory. This project aims to provide an apparatus for undergraduate students to work with plasmas through a hands-on, visual set of experiments. The finished apparatus will allow for three laboratory experiments. Each of these experiments is designed for different levels of student. The first experiment helps students to get familiarized with how plasmas are formed. The next introduces students to a key instrument in plasma physics, the Langmuir probe. And lastly, advanced students can explore plasma wave phenomena using dust particles in the plasma. The end result of this project is to provide a permanent addition to the undergraduate laboratory curriculum.

61 - Dani Lipman

Majors: Physics, Astronomy

Mentor: Jasper Halekas (Physics & Astronomy)

Characterizing the Structure of the Martian Bowshock

Understanding the Martian bow shock can be helpful in modeling the evolution of the Martian atmosphere over time as the solar wind interacts with the upper atmosphere of Mars. I use data from the Mars Atmosphere and Volatile Evolution (MAVEN) mission to analyze the bow shock in terms of particle density versus time. I have developed an algorithm to fit step functions to bow shock profiles and find the approximate locations of the shock over many orbits. These profiles are then used to statistically determine the average structure of the shock and how it varies as a function of a variety of solar wind conditions.

63 - Brianna Lupo

Majors: Biology, Biochemistry

Mentor: Catherine Musselman (Biochemistry)

The molecular basis of multivalent DNA binding by the BRM AT-hook and Bromodomain

The remodeling of chromatin structure to repress or activate regions of DNA is critical in the control of gene expression. The nucleosome core is comprised of a histone octamer wrapped by ~147 base pairs of DNA. Remodeling is largely facilitated through ATPase complexes and involves

repositioning the DNA around the histone. Remodeling complex activity is influenced by local chromatin environment including nucleosome architecture and post-translational modifications which can alter recruitment and activity of the complexes at chromatin.

The SWI/SNF family of chromatin remodelers includes the BAF complex, which consists of subunits of Brahma (BRM) or Brahma-related gene 1 (BRG1). These ATPase subunits are mutated in various cancers. Both contain a C-terminal bromodomain that binds acetylated histone tails. This bromodomain can also bind DNA. Adjacent is an AT-hook, a small motif that binds DNA, and the bromodomain and AT-hook bind DNA multivalently. However, the molecular details underlying this association are still largely uncharacterized.

We are using NMR spectroscopy and Fluorescence Anisotropy to further characterize the binding activity of the BRM AT-hook and bromodomain to nucleosomes and isolated DNA. The relative contribution of the AT-hook, the bromodomain, and the role of the linker between this region is being investigated.

65 - Zachary Luppen

Majors: Astronomy, Physics

Mentor: Tushar Thrivikraman (NASA Jet Propulsion Lab)

Integration, Testing and Automation for the Europa Clipper REASON Instrument at the NASA Jet Propulsion Laboratory

This work involves the development and testing of software to communicate with the REASON instrument, as well as interface with the test equipment it will be connected to. Code has already been written in Python 3.5 by my mentor Tushar to perform some of these functions and access the equipment. Some, though, not all, of these programs have been made into graphical user interfaces (GUIs) to simplify their complexity and make them easy to use. Under Tushar, I am continuing this work and developing interfaces for several functions. I wrote one GUI to record power data over time for multiple channels and live plot it over time, while another was to operate the DC power analyzer and record its channel values. Additionally, I have been debugging some of the scripts already written and optimizing their performance and abilities.

67 - Jared McGinnis

Major: Chemical Engineering

Mentor: Julie Jessop (Chemical and Biochemical Engineering)

Eliminating Oxygen Inhibition during Photopolymerization Reactions via Hybrid Epoxide Acrylate Formulations

Photopolymerization is a common method used in industry to cure polymer products such as inks, thin films, and adhesives. During photopolymerization, UV light cleaves photoinitiators to produce radicals, which react with liquid monomer to form solid polymer. The radicals can also react with oxygen in the air to form unreactive species that suppress polymerization, creating a problem known as oxygen inhibition. This leads to a tacky layer on the surface of the polymer products. Current methods to eliminate oxygen inhibition, such as nitrogen inertion, are costly. This project aimed to eliminate oxygen inhibition by introducing a second monomer into the formulations that could polymerize via a cationic mechanism. Unlike radicals, cations are not sensitive to oxygen in the air, and thus, can achieve tack free surfaces even in ambient conditions.

69 - Emily McLain

Majors: Communication Studies; Criminology, Law, and Justice

Mentor: Wayne Jacobson (Office of Assessment)

Taking Temperature: An Interpretive Analysis of Student Meaningful Experiences

This study examined individual survey responses of perceived meaningful experiences during undergraduate education to gain insightful information regarding the University of Iowa and the impact that practices had on the student body. The data within this study is comprised of 4131 total surveys; 2967 of which responded to the prompt. This study aims to expand on previous research on student perceived meaningful experiences while also continuously developing response categories and concepts. These experiences, while limited by the time in which they were perceived, also allow for a cross-sectional analysis of data from the previous 2016 data set. The findings from this data set suggest that while meaningful experiences perceived by respondents across categories of gender, academic year, and race insignificantly differ, the data derived from within the content of the response itself provides greater insight.

71 - Camille Mumm

Majors: Biology, Informatics

Mentor: Robert Cornell (Anatomy and Cell Biology)

KLF4 dependent regulation of periderm enhancers upstream of zebrafish and human periplakin

Orofacial clefting (OFC) is a common birth defect affecting nearly 4,500 babies born in the United States each year. Interferon Regulatory Factor 6 (IRF6), an important transcription factor in the development of the early embryonic epithelia (periderm), promotes periderm differentiation and is known to cause OFC. However, most of the heritable risk for non-syndromic OFC is unknown. Aberrant differentiation of the oral periderm can cause OFC. The aim of this project is to determine the sequence underpinnings of periderm enhancers using zebrafish as a model. By integrating H3K27Ac ChIP-Seq, Irf6 ChIP-Seq, and ATAC-Seq data, we have identified multiple periderm enhancer candidates. One of them is approximately 10kb upstream of periplakin (ppl), a periderm specific gene. We have confirmed in transgenic GFP reporter assays periderm specific activity of this candidate ppl enhancer. In addition we have identified a region upstream of human Periplakin with similar sequence features that is also active in the periderm. The activity of both of these enhancers is dependent on the presence of a KLF4 (Kruppel Like Factor 4) binding sites. Dissection of this model enhancer can illuminate upstream transcriptional regulators and facilitate in elucidating the periderm GRN structure, ultimately informing us of candidate OFC risk loci.

73 - Taryn O'Brien

Major: Biology

Efficacy of anti-Annexin A2 antibody as a treatment for Oxygen Induced Retinopathy (OIR)

Annexin A2 is a cell-surface phospholipid-binding protein that is responsible for activating fibrinolytic plasmin. Plasmin promotes hypoxia-induced angiogenesis due to its increased clearance of perivascular fibrin. It has been previously demonstrated that Anxa2 ^{-/-} Mice exhibit fibrin accumulation which lowers rates of angiogenesis (blood vessel formation). In this study, we examined the efficacy of anti-AnnexinA2 antibody in the prevention of Oxygen Induce Retinopathy (OIR), the mouse model of Retinopathy of Prematurity (blindness affecting premature infants). We induced relative hypoxia by placing 7 day old pups in a 75% O₂ chamber and removing them at 12 days of age. At this time, anti-annexin A2 antibodies were injected into the vitreous of the left eye, while the right eyes were left non-injected to serve as controls. Five days after the injection, eyes were sectioned and fluorescently labeled in order to quantify angiogenesis. We found the general trend that eyes injected with anti-annexin A2 antibodies displayed less angiogenesis than

than non-injected eyes. It was concluded that eye injections of anti-annexin A2 antibodies under relative hypoxia can reduce the harmful and unregulated neovascularization that occurs during hypoxia induced angiogenesis.

75 - Jennifer Ong

Major: Biology

Mentor: Kelly Messingham (Dermatology)

Skin-resident dendritic cell populations are altered in Bullous pemphigoid, an autoimmune blistering disease

Bullous pemphigoid (BP) is an autoantibody-mediated autoimmune disease. BP autoantibodies primarily target a skin attachment protein, known as BP180. Autoantibody binding to BP180 leads to inflammation and loss of epidermal adhesion that manifests clinically as skin blistering. Dendritic cells (DCs) are key regulators of autoimmunity due to their ability to stimulate or inhibit other immune cells. Suppression of autoimmunity is dependent on tolerogenic DCs, known to secrete TGF- \hat{I}^2 and IL-10. The goal of this project is to determine if the number or tolerogenic function of skin DC sub-populations is altered in BP. To achieve this, biopsies were obtained from BP patients or age- and sex-matched controls, placed thin (5-7 $\frac{1}{4}$ M) cryosections on glass slides and then immunostained with fluorescently labeled antibodies specific for skin DC subpopulations (epidermal Langerhans cells, and CD1c, CD14 and CD141+ dermal DCs) and TGF- \hat{I}^2 and IL-10. Images were captured with a Nikon photomicroscope equipped with epifluorescence and positive staining was analyzed with NIH ImageJ. It was determined that; 1) epidermal Langerhans cells were significantly decreased in BP skin, while CD1a DC were increased; and 2) CD1a and CD141+ DCs primarily produce IL-10, while CD14+ DCs produce only TGF- \hat{I}^2 .

77 - Pooja Patel

Major: Biomedical Sciences

Mentor: Renata Pereira (Internal Medicine)

OPA1 Deficiency in BAT Results in Increased Cold Tolerance, Despite Impaired Mitochondrial Function in Female Mice

Optic Atrophy 1 (OPA1) is a mitochondrial protein that regulates mitochondrial dynamics, function and morphology. The role of OPA1 in brown adipose tissue (BAT) physiology is incompletely understood. To investigate the specific role of OPA1 in BAT on the adaptation to acute

cold stress, we crossed OPA1 floxed mice with mice harboring the CRE recombinase under the control of the UCP1 promoter to delete OPA1 specifically in BAT (KO mice). Mice were kept at 4°C for a total of 4 hours, after a 7-day acclimation at 30°C, and core body temperature was monitored hourly. As expected, mitochondrial respiratory capacity in BAT was reduced and mitochondria morphology was compromised in KO mice. KO mice had increased heat production and oxygen consumption, indicating increased basal metabolic rates, and they were more tolerant to acute cold stress than control mice. Interestingly, mitochondrial respirations were elevated in the inguinal white adipose tissue (iWAT) of KO mice, which correlated with increased UCP1 protein levels and induction of thermogenic genes, suggesting browning of iWAT. Taken together, our data suggest that despite impaired mitochondrial function in BAT, KO mice had increased basal metabolic rates and were resistance to cold stress, likely due to increased browning of iWAT.

79 - Allison Peroutka

Major: Chemical Engineering

Mentors: Tori Forbes (Chemistry), Dave Cwiertny (Civil & Environmental Engineering)

Phosphonic Acid Functionalized Electrospun Nanofibers for Uranium (VI) Uptake

There are communities in the United States that are threatened with exposure to high concentrations of uranium in their drinking water due to leakage from abandoned uranium mines. Uranium is considered a nephrotoxin, which has many harmful consequences including the potential risk for cancer. The most prevalent form of uranium in aqueous solution is U(VI) in the form of the uranyl cation. The goal of this project is detection of U(VI) in groundwater and eventually extraction, which we target through the coupling of engineering concepts with chemical techniques to develop new material and understand binding preferences of U. Initial efforts use polyacrylonitrile (PAN) electrospun nanofibers, which are combined with various phosphonic acid surfactants for selective uptake of U. After soaking in solution of known concentration of uranium, the functionalized nanofibers are analyzed for total uptake using both Liquid Scintillation Counter (LSC) and Inductive Coupled Plasma-Mass Spectroscopy (ICP-MS). Changing the surfactants chemistry via adjustment of the carbon chain, and total uptake of uranium is observed with the longer chains, are confirmed by both LSC and ICP-MS results. In addition, stability of the surfactants was assessed and washing

experiments indicated variable incorporation of the phosphonate groups that are dependent on chain length.

81 - Megan Powers

Majors: Environmental Science, Biology

Mentor: Bradley Cramer (Earth and Environmental Sciences)

Factors impacting Lucinid bivalve and seagrass symbioses within the Sanibel-Captiva area, SW Florida

Bivalves of the family Lucinidae have been shown to exist within ecologically important symbioses between seagrass, the lucinid bivalve, and the bivalve's endosymbiotic sulfide-oxidizing bacteria. The roots of the seagrass support the clams through root radial diffusion of oxygen, while the lucinids introduce dissolved oxygen for sulfide oxidation through burrowing in the sediment. In addition, the lucinids' chemosynthetic endosymbionts oxidize otherwise potentially phytotoxic levels of pore-water sulfides while also providing their host with a supplemental energy source. Because seagrass beds play an important ecological role throughout the waters of SW Florida, a survey of seagrass biomass, bivalve abundance, and sulfide porewater throughout 19 sites in the region was conducted to evaluate the importance of this symbiotic relationship. No significant relationships were found between pore-water sulfide levels and lucinid abundance or seagrass biomass. Seagrass bed lucinid abundances ranged between 0 and 226 individuals per square meter. The analysis of samples throughout the study area showed a positive correlation between seagrass biomass and lucinid abundance. This finding provides the possibility of lucinid bivalves being used as an indicator of seagrass health in the future and further strengthens evidence for a positive symbiotic relationship between seagrass and lucinid bivalves.

83 - Guowei Qi

Majors: Biochemistry, Mathematics, Computer Science

Mentor: Michael Schnieders (Biochemistry)

Automating Protein Side-Chain Refinement: Application to Force Field X

Where experimental data is lacking, biochemists can supplement their studies of proteins with the analysis of Protein Data Bank (PDB) files. When accurate, PDB files provide high-quality models that can be applied to translational genetic research. To systematically refine protein structures for genetic disease research, we employ Dead End Elimination

(DEE) criteria to a discrete set of side-chain conformations, called rotamers, using the Force Field X (FFX) molecular biophysics software. FFX algorithms eliminate high-energy rotamers and calculate the conformations that lead to a Global Minimum Energy Conformation (GMEC). However, optimization efforts currently require hours of manual calculation and human observation. Complete optimization and data collection can take weeks for a large collection of structures. The Protein Refinement Pipeline (PRP) automates the application of FFX refinement algorithms to PDB homology models. A process that originally required constant manual input and 10 checkpoints per PDB file now takes three total checkpoints for any collection of proteins. On average, the PRP script decreases the time needed to set-up and run refinement calculations on PDB files by 8.38 times. As a result, a larger number of structures can be refined and a database of detailed protein information can be constructed.

85 - Emily Silich

Majors: Astronomy, Physics, Mathematics

Mentor: Philip Kaaret (Physics & Astronomy)

HaloSat: a CubeSat Mission in Search of Missing Baryons

Approximately 5% of all mass in the universe is made up of normal, baryonic matter. Being comprised of protons and neutrons, baryonic matter is the foundation of everything that astronomers observe in the universe. Yet, observations of the nearby universe fail to locate about one third of the baryonic matter observed in the early universe; this is known as the Missing Baryon Problem. A possible explanation for this discrepancy is that the missing baryons are located in hot galactic halos emitting X-rays, such as that of the Milky Way. HaloSat is a NASA-funded CubeSat mission that will allow for the study of the soft X-ray signature in the Milky Way's extended galactic halo. Launched in May 2018, HaloSat is comprised of three independent X-ray detectors, each of which is able to detect X-rays around the range of 0.4-8.0 keV. HaloSat will be the first mission to obtain a spectrally well-resolved map of OVII and OVIII emissions across the entire galactic halo, which will allow for its baryonic mass and geometry to be determined. Once analyzed, this data can be applied to galaxies throughout the universe and help resolve the Missing Baryon Problem.

87 - Nicholas Stange

Major: Biomedical Sciences

Mentors: Gerene Denning (Emergency Medicine), Charles Jennissen (Emergency Medicine)

An Analysis of Iowa Off-Highway Vehicle Roadway County Ordinances

Off-highway vehicles (OHVs), which include all-terrain vehicles (ATVs) and side-by-sides (SxSs), are designed for off-road use only. Despite this, an increasing number of states, counties and cities are opening up public roads and streets to OHV traffic, leading to potential increases in deaths and injuries. The study objective was to identify Iowa counties that had passed OHV roadway ordinances, and to determine what restrictions and safety requirements were included. Ordinances or resolutions that allowed OHVs on public roads were requested from Iowa counties and reviewed.

From 2011-2017, 38 of Iowa's 99 counties passed enactments allowing OHVs on at least some public roads. Many other quantitative statistics were generated detailing any safety or injury prevention measures that were taken. The results show that speed restrictions, time restrictions, and age restrictions are quite varied, while safety requirements, such as helmet use, seatbelt use, and visibility requirements, are largely absent. In conclusion, county regulations related to OHV use of public roads in Iowa vary greatly, and often do not address known safety and injury prevention issues. These data will be vital in future studies comparing roadway injuries and deaths in Iowa counties before and after OHV public roadway use enactment.

89 - Jordyn Steinkritz

Major: Finance

Mentor: Cathy Zaharis (Finance)

The Current Retirement Status & Cost Analysis

America is facing a major retirement problem as fewer workers are saving for retirement and less guaranteed income is forecasted to be available as the retirement landscape continues to change. One major problem Americans face is not knowing how to set an appropriate goal for the size of their nest egg. There are a variety of different factors influencing personal goals, but on a generalized basis, average annual expenditure during retirement years equates to 69% of an final average income level for workers ages 55-64.

91 - Gustave Stewart

Majors: Political Science, Economics

Mentor: Elise Pizzi (Political Science)

Inequality, Urban Goods, and Participatory Budgeting within Brazil

With increasing urbanization, cities have become more populated and the demand for urban infrastructure has increased. Brazil cities have high inequality in terms of urban environment and income. The increase in urbanization has put pressure on municipal services and led to difficulty for local governments to distribute urban infrastructure such as road, sidewalks, public lighting, afforestation, open sewage, and wheelchair ramps across wage groups. The analysis looks at these urban goods in 196 Brazilian municipalities and identifies the presence of two types of goods (higher-wage goods and lower-wage goods). Higher-wage goods are goods where participatory budgeting (PB) benefits higher wage individuals the most and has an increase in the difference in access. Comparatively, lower wage goods are those where lower wage individuals benefit more from PB and has a decrease in the difference in access. This paper finds that PB has different effects on the distribution of urban goods across the different wage groups.

93 - Hanxi Tang

Major: Biology

Mentors: Toshihiro Kitamoto (Anesthesia), Patrick Lansdon (Anesthesia)

Gut microbiota composition is significantly affected by a seizure-causing voltage-gated sodium channel mutation in Drosophila

The gut microbiota plays critical roles in the metabolism as well as immunity of the host animals and is essential for their health and well-being. Recent studies indicate that gut microbiota has significant effects on development and functions of the brain, ultimately influencing behaviors. The communication between the gut microbiota and the brain is complex and likely bidirectional. However, it remains largely elusive how the brain interacts with microbes in the gut and modulates their biological activities. 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 critical for nervous system function and play a central role in generating and propagating action potentials. Mutations in human Nav channel genes are implicated in various disorders of the nervous system, such as epilepsy, autism, ataxia, and pain syndromes. *Drosophila paraShu* mutants exhibit severe neurological phenotypes, including neuronal hyperexcitability, spontaneous tremors, and heat-induced seizures. We examined the gut microbiota composition and unexpectedly found that, compared to wild-type flies, mutants harbor fewer bacteria and a greater number of eukaryotic microbes. These eukaryotic microbes were subsequently identified as a species of yeast, *Candida freyenschussii*. We currently investigating underlying

mechanisms of this finding that abnormal Nav channel activities lead to altered gut environment.

95 - Emma Thayer

Major: Human Physiology

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

255 nm light emitting diode (LED) in combination with Bleach (NaClO) is more effective in killing E. faecalis in root canal therapies

Introduction: Treatment of infected or inflamed endodontic tissues requires chemo-mechanical debridement of canal spaces, unfortunately, infections can reoccur. In this study, we assessed the ability of bleach (NaClO) in combination with 255 nm LED to kill *Enterococcus faecalis*, a bacteria associated with persistent reoccurring infections after treatment.

Methods: *E. faecalis* was put into holes in a blood agar plate and treated with water (control), 255 nm LED and water, 1% NaClO, 255 nm LED then 1% NaClO, or 1% NaClO then 255 nm LED. The holes were rinsed and treatments were spotted onto blood agar. At 24 hours, colonies were counted.

Results: *E. faecalis* remained viable in control treatments (38.1+1.6 SEM CFU, n=18). The treatments of *E. faecalis* with 255 nm LED (9.8+0.7 SEM CFU, n=18, p < 0.05), 1% NaClO (10.1+1.2 SEM CFU, n=18, p < 0.05), 255nm LED then 1% NaClO, (2.1+0.4 SEM CFU, n=18, p < 0.05), and 1% NaClO then 255nm LED (1.2+0.3 SEM CFU, n=18, p < 0.05) had significantly less CFU.

Conclusion: The results in this study suggest a new treatment modality using 255 nm LED and NaClO in combination as an adjunct to chemo-mechanical debridement for the sterilization of infected and inflamed sites.

97 - Jamie Tigges

Major: Environmental Science

Mentor: Heather Sander (Geographic and Sustainability Sciences)

Mesopredator influence on Passeriformes

In a healthy ecosystem population dynamics and the interconnection of food chains is a complex topic of study. Many organisms depend on multiple others for sustenance, and a single prey creature faces threats from a plethora of predators. Urban environments add yet another variable into the equation, that of fragmented habitats, amplified edge effects, and anthropogenic factors. What, then, can we expect to see when measuring occurrence of mesopredators to the species population of observed Passeriformes order of birds? From first sight it may appear that birds are at an advantage when dealing with predator conflicts,

however during nesting season when chicks are young the parents must be at constant attention to threats in the area. Through the use of camera traps, and systematic birding we collected data detailing whether or not a specific mesopredator was on site, and the population of birds observed. What we found were numerous positive relationships which could be indicating a preference to shared habitats between specific Passeriformes species and a predator. We also found significant negative relationships, which may indicate predation or a habitat which is not normally shared. This study may serve as a basis to continued research into urban food webs, or be expanded into wintering species to observe behavior when out of the nesting season. It could be helpful to consider other predators as well, such as raptors, snakes, or rodents, which may have been suppressed by the mesopredators in this species leading to positive relationships.

99 - Nitya Virippil

Major: Human Physiology

Mentors: Prajwal Gurung (Internal Medicine), Matthew Yorek (Internal Medicine)

Heligmosomoides Polygyrus infections benefit C57BL/6 mice during sublethal radiation

Radiation exposure is an increasing environmental risk to humans. Low dose radiation exposure of 4 Gray (Gy) and under are not fatal. However, the long-term effects of these exposures impact quality of life. We tested the hypothesis that infection with helminth *Heligmosomoides polygyrus* (*H. polygyrus*), alleviates radiation- induced toxicity by promoting cell survival. C57BL6/J mice were infected with 150 *H. polygyrus* L3 larvae by oral gavage. Infection was confirmed by observing eggs in the animals' feces post infection. Peripheral blood was collected by retro-orbital vein and assessed by flow cytometry for general inflammatory cell markers. Following 12 days of *H. polygyrus* infection Neutrophils, Natural killer cells, Dendritic cells, and B cells show elevated numbers. Effector and T regulatory cell populations expanded for both CD4 and CD8 T cells, while both naïve CD4 and CD8 cells reduced in abundance. Next, animals were subjected to 4 Gy whole body radiation. Preliminary data showed increased survival of lymphocytes from *H. polygyrus* infected mice during sublethal irradiation. *H. polygyrus*- infected mice have less reduced weight changes following radiation exposure. The protection provided by *H. polygyrus*-infection during irradiation may be a natural strategy for high-risk radiation groups that include nuclear plant workers and radiotherapy patients.

101 - Olivia von Gries

Majors: Art History, Studio Art

Mentor: Robert Bork (Art History)

Analyzing Geometrical Composition Strategies in Renaissance Painting

Renaissance paintings often have an uncanny character, because they appear both realistic and artificial, with compositions involving deliberately conceived symmetries and systems of order. Many scholars evaluate the development of linear perspective, an artistic breakthrough during the Renaissance, but few have studied the more straightforward and equally important geometrical armatures that govern Renaissance paintings on their surfaces. This version of the research mentor's project aimed to more fully understand the geometric relationships that appear to determine many Renaissance paintings' compositions and the reasoning behind such. Literature surrounding the topic, including Classical texts emphasizing the importance of geometry or explaining artist treatises as well as modern-day analyses of the subject, was gathered and reviewed to see if it would support the hypothesis or not. Additionally, using AutoCAD computer software, geometric analyses of Renaissance era paintings were undertaken to map out the possible geometry used to arrange the forms within the paintings. Finally, the last component to the ICRU fellow's research was recreating previous AutoCAD analyses of paintings done both by the research mentor as well as other scholars on the topic to see if they were accurate or misinformed.

103 - Kathleen Wade

Major: Chemical Engineering

Mentor: Charles Stanier (Chemical Engineering)

Analyzing Wind and Particulate Matter Around Lake Michigan

This project was to use the program Matlab to analyze the data found in the 2017 Lake Michigan Ozone Study. Data was collected by aircraft, mobile labs and ground-based sensing systems. This data contains information about potential temperature, winds, ozone and particulate levels. My project was to assist 2nd year Ph.D. graduate student Megan Christiansen to determine patterns in the pollution and wind data from the Zion, IL ground site. We also tested to see if the Stanier group simulations of winds and pollution reproduce the measured patterns.

105 - Lexy Wadsworth

Major: Human Physiology

Mentor: Adam Dupuy (Anatomy and Cell Biology)

A Forward Genetic Screen Identifying Mechanisms of BRAFV600 Mutant Melanoma Drug Resistance

Approximately 50% of patients with metastatic melanoma harbor BRAFV600 mutations. These mutations increase activation of the MAPK signaling pathway, leading to increased cell proliferation and survival. Inhibition of this pathway with vemurafenib, a kinase inhibitor that specifically targets BRAFV600 mutations, and in combination with cobimetinib, a MEK inhibitor, is initially encouraging in patients. Unfortunately, ~80% of patients develop resistance to these targeted therapies. While some resistance mechanisms are known, a large portion of patients present without known mechanisms of resistance. In an effort to discover unknown mechanisms of resistance, we performed a forward genetic screen using the Sleeping Beauty transposon system. We were able to identify and subsequently validate four candidate drivers of resistance. Two of the genes found in our screen have been previously established as resistance drivers in humans, validating our approach. The other two candidate drivers were Dbl family guanine nucleotide exchange factors. By overexpressing these genes in melanoma cells, we were able to determine that through the PAK signaling pathway, ERK signaling was reestablished to drive MAPK inhibitor resistance. By targeting these Dbl family members with the drug saracatinib in combination with vemurafenib, we were able inhibit this resistance pathway.

107 - Rion Wendland

Major: Biomedical Engineering

Mentors: Luke Wiley (Ophthalmology and Visual Sciences), Kristan Worthington (Biomedical Engineering)

Design and Testing of a CRISPR-Cas9 Construct to Tag Endogenous CLN3

Batten disease is a neurodegenerative disorder that causes blindness, epilepsy, and death due to mutations in CLN3, which encodes a protein expressed in lysosomes and endosomes within cells. While studies have linked CLN3 to different cellular pathways, the reason mutations lead to neurodegeneration remains unclear. We sought to design a genome editing approach via CRISPR-Cas9 to tag CLN3 to better understand its role within neurons.

Five small guide RNA (sgRNA) sequences were designed, ligated into a

plasmid, and transfected into HEK293T cells. Once the plasmids' specificity was demonstrated in HEK293T cells, human iPSCs were transfected and guide efficiencies were quantified via cloning and Sanger sequencing of CLN3. In HEK293T cells, all five sgRNAs (spg1-5) demonstrated successful transfection and modification of CLN3. In iPSCs, only guides spg1-3 demonstrated successful transfections. Quantitative analysis of spg1-3 revealed spg1 had the highest modification efficiency. Thus, spg1 was chosen to be utilized in future experiments.

An effective guide sequence is essential when designing a CRISPR-Cas9-mediated approach. We determined the most promising sgRNA, spg1, and future experiments will involve co-transfection of iPSCs with spg1 and the homology directed repair construct. This construct contains both a fluorescent tag (eGFP) and a peptide moiety (FLAG) that will allow for visualization and isolation of CLN3 protein, respectively.

109 - Michael Westphal

Majors: Human Physiology

Mentors: Renata Pereira (Internal Medicine) E. Dale Abel (Internal Medicine)

OPA1 Deficiency in Brown Adipose Tissue Prevents Diet-Induced Obesity and Insulin Resistance

Optic Atrophy 1 (OPA1) is a mitochondrial protein that regulates mitochondrial dynamics and function. Normal mitochondria function is critical to maintain the appropriate balance between energy storage and expenditure in adipocytes. Particularly in brown adipocytes, proper mitochondrial function is required for adequate thermogenic activation. However, the role of OPA1 and mitochondrial dynamics in brown adipose tissue (BAT) physiology is incompletely understood. In the present study, we sought to test the hypothesis that OPA1 is required for the physiological adaptations of BAT to diet-induced obesity (DIO). We generated mice lacking OPA1 specifically in BAT by crossing mice floxed for the *Opa1* (OPA1 BAT-KO) gene with mice harboring the Cre recombinase under the control of the UCP1 promoter. To test the role of BAT OPA1 in the adaptation to DIO, we fed OPA1 BAT-KO and wild type (WT) mice either a 60% high-fat diet (HFD) or 10% fat control diet (Cont) for 12 weeks. As expected, mitochondrial respiratory capacity was reduced in BAT mitochondria isolated from KO mice. However, mitochondria respirations were elevated in the inguinal fat pad of these mice, which correlated with increased UCP1 protein levels, suggesting browning of white adipose tissue. Surprisingly, OPA1 BAT-KO mice were completely protected from DIO, as demonstrated by preserved body weight and fat mass relative to WT mice.

111 - Cheng Zha

Major: Biomedical Engineering

Mentor: Sarah Vigmostad (Biomedical Engineering)

Seeking the Real-time Pattern and Level of Air Pollution

This research is about developing a way to provide prevention of air pollution for certain groups of people and also establish a real-time alerting system to remind people they are in an environment with air pollution or not. Based on the real world experience, most people would still choose the face mask to prevent insignificant air pollution like smog when they realize it is existing in their working or living environment. Developing a way to combine the face mask with an air pollution detector would provide a more convenient way to help people in that kind of situation. In this way, people who already exist in an insignificant air pollution environment would be benefited at most. Because this device will provide them a chance to prevent the minor air pollution at first and then alert them when the air pollution could not be prevented by their facemask anymore. On the other hand, people who choose to use the device would be able to have many more details information about their working and living environment based on the air data collection.

113 - Lexi Zocher

Major: Human Physiology

Mentor: Gordon Buchanan (Neurology)

An examination of brain regions activated in CO₂-induced arousal from sleep

CO₂-induced arousal is a critical protective mechanism. This mechanism is dysregulated in obstructive sleep apnea, sudden infant death syndrome, and sudden unexpected death in epilepsy. Serotonin (5-HT) neurons in the midbrain dorsal raphe nucleus (DRN) are important for CO₂-induced arousal; however, which sites are activated downstream of DRN 5-HT neuron activation is unknown. To examine this we planned to examine neuronal activation via c-fos expression in putative target sites. Adult male wild type (Lmx1bf/f) and 5-HT neuron-deficient (Lmx1bf/f/p) mice were challenged with inspired CO₂ (or room air) or received perfusions of normal or CO₂-enriched artificial cerebrospinal fluid (aCSF) into the DRN through stereotactically implanted microdialysis cannulae. Immediately following trials, animals were euthanized, intracardially perfused, the brains extracted, cryoprotected, frozen, sectioned, and immuno-stained for c-fos. Currently, c-fos+ cells are being counted in

medial septal nucleus, diagonal and horizontal bands of Broca, tuberomammillary nucleus, DRN, and pedunculopontine tegmental nucleus all which are believed to be part of the arousal system. Based on the pattern of c-fos activity we will be able to determine which sites increase their activity in response to the challenges, which activated sites depend on 5-HT neurons, and ultimately which connections are most important in CO₂-induced arousal.

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

2 - Brittany Allendorf

Major: Human Physiology

Mentor: Kelly Messingham (Dermatology)

Evaluation of keratinocyte cytokine production as a potential mechanism of autoimmunity in Bullous pemphigoid

Bullous pemphigoid (BP) is an autoantibody-mediated autoimmune disease. BP autoantibodies primarily target a skin attachment protein, known as BP180. Autoantibody binding to BP180 leads to its internalization, complement activation and subsequent inflammation. This leads to loss of epidermal adhesion that manifests clinically as skin blistering. The skin is a complex tissue composed of keratinocytes and immune cells, among others. Although not typically considered an immune cell, keratinocytes are capable of up or down-modulating immune cell functions through their production of cytokines. The goal of this project was to characterize the cellular source and relative levels of 3 cytokines, thymic stromal lymphopoietin (TSLP), IL-31 and IL-33 in skin from BP patients or controls. To achieve this, we obtained skin biopsies from BP patients or age- and sex-matched controls, placed thin (5-7 ¼M) cryosections on glass slides and then immunostained with cytokine-specific antibodies followed by fluorescent secondary antibodies. Images were captured with a Nikon photomicroscope equipped with epifluorescence and positive staining was analyzed with NIH ImageJ. Levels of all 3 factors were increased in lesional biopsies from BP patients and ongoing studies will pinpoint the cellular source(s) of these factors.

4 - Maya Altemeier

Majors: Public Health, Biochemistry

Mentors: Wen Liu (College of Nursing), Ryan Carnahan (College of Public Health)

Characteristics of Staff-Resident mealtime verbal communication and relationship with intake in Nursing Home Residents with Dementia

As our population ages, increasing numbers of adults will be entering long-term care facilities. Relatively little research has been published on the relationship between caregiver-resident communication at mealtime and resident nutritional outcome. This poster summarizes patterns of and relationships between staff-resident mealtime verbal communication and intake in nursing homes. The sample included 111 observations of 25 residents, 29 staff members, (42 unique staff-resident dyads) in 9 nursing homes. It was found that 78% of feeding attempts were successful, and 22% of attempts were unsuccessful. The feeding assistants spoke most frequently with 68% of total verbal communication codes, and they spoke primarily to residents, with 72% of feeding assistant codes. Both the resident and other person-types spoke most frequently to feeding assistants. Feeding assistant, other staff, and resident top three codes were all positive. A spearman correlation test was used to describe the relationship between verbal communication and intake. There was a significant positive correlation between total intake/minute and total codes/minute ($\rho = 0.43$, $p < 0.001$) and there was a positive correlation between successful intake/minute and positive codes/minute ($\rho = 0.43$, $p < 0.001$). This provides evidence that there is a positive relationship between both verbal communication and intake attempts, and positive verbal communication and successful intake.

6 - Isabella Penniston

Major: Nursing

Mentor: Stephanie Gilbertson-White (Nursing)

Examining Depression and Anxiety in Rural Advanced Cancer Patients Receiving the OASIS Intervention

Up to 40% of cancer patients report clinically significant levels of depression or anxiety. While web-based interventions have examined the management of multiple symptoms for advanced cancer patients, they rarely evaluate the impact of symptom management on mood-state indicators (depression and anxiety). Rural advanced cancer patients have less access to symptom management specialists than their urban/

suburban peers. Thus, Oncology Associated Symptoms and Individualized Strategies (OASIS) was developed to respond to this need. OASIS is a web-based symptom management intervention that supports the development of self-management skills for patients. The purpose of this study is to examine the relationships among clinical and demographic characteristics and mood scores (anxiety and depression) in advanced cancer patients participating in OASIS. Baseline and three follow-up surveys were collected from participants (n=17). Surveys consisted of a demographic questionnaire along with single-item numeric ratings of severity and distress for anxiety and depression (range: 1-10). Analyses include descriptive statistics, change scores, and correlation tests. After evaluating normal distribution, appropriate parametric or non-parametric tests were chosen to examine relationships. Simple characteristics are described. Correlation between demographic characteristics and mood scores of all participants and an analysis of score for those who completed all four time points will be presented.

8 - Joseph Burba

Major: Biochemistry

Mentor: Madeline Shea (Biochemistry)

Clinically Isolated Calmodulin Mutations and their Effects on Calcium-Dependent Ligand Binding

10 - Aimee Butler

Major: Microbiology

Mentors: Douglas Spitz (Free Radical and Radiation Biology), Melissa Fath (Free Radical and Radiation Biology)

Disulfiram and copper with standard of care therapies increases small cell lung cancer toxicity

There have been 234,030 new lung cancer patients so far in 2018. Of the 234,030 new patients about 15% are diagnosed with small cell lung cancer (SCLC). The five-year survival rate for SCLC varies between 2-31% depending on the stage at diagnosis. For SCLC the current SOC therapy are four to six rounds cisplatin and etoposide with radiation daily for three to seven weeks. However, some tumors do not respond to these treatments. As the tumor progresses a larger fraction becomes hypoxic due to restricted blood flow. Cells that can survive in hypoxic conditions become resistant to the SOC treatments. Our goal is to use disulfiram (DSF) and copper to sensitize SCLC to chemo-radio-therapy in both

normoxic and hypoxic conditions. DSF is an FDA approved drug that was previously used to treat alcoholism. DSF is affordable and less toxic to the body than other forms of cancer treatment. DSF works by delivering Cu to cancer cells and reducing Cu(II) to its reactive form, Cu(I), creating toxicity in the cell. Cu(I) reacts with O₂ and produces superoxide (O₂⁻), which then dismutates to hydrogen peroxide (H₂O₂). These reactive oxygen species (ROS) then cause toxicity to the cancer cells. In our studies, we tested DSF's effect on cell toxicity and showed that DSF with Cu is more toxic to hypoxic cancer cells, causes radio-chemo-sensitization, and is tolerable to mice in a xenograft model.

12 - Claire Carlson

Majors: Environmental Science (Hydroscience), Geoscience

Testing aquaculture techniques on the growth rates of macroalgae in Tarpon Bay, SW Florida

In many coastal areas, excess nutrients from terrestrial sources have led to rapid growth in hypoxia, algae blooms and loss or degradation of habitat. Macroalgae is well-known for ecosystem services including nutrient sequestration and can be used to restore eutrophic waterways, while simultaneously creating economic opportunities through aquaculture practices.

To determine the viability of macroalgae aquaculture in Tarpon Bay (part of the J.J. Ding Darling National Wildlife Refuge) in Sanibel, Florida, three testing sites along with two different techniques (enclosed vs. exposed) were established and tested over a period of four weeks. All three testing sites were equipped with two macroalgae aquaculture lines that featured each of the three species of macroalgae being tested. In addition, one line at each site featured exposed macroalgae attached by fishing line and the other held macroalgae samples enclosed in mesh bags. The goal of this project was to see which method would lead to the greatest amount of algal growth, as well as which techniques were the most influential for aquaculture success in Tarpon Bay. Daily data was taken from each site and other experiments were conducted to help determine flow rates, nutrient content of water, and strength of each macroalgae species.

14 - Grace Coen

Major: Biochemistry

Mentor: Chad Grueter (Internal Medicine), Jessica Ponce (Internal Medicine)

Stress Induced Translocation of Cyclin C Regulates Cardiac Mitochondrial Dynamics

Heart disease (HD) is the leading cause of death in the United States. One major complication associated with HD is decreased mitochondrial function. Imbalanced mitochondrial dynamics leads to metabolic remodeling, deficits in cardiac energetics, and increased reactive oxygen species. Cyclin C (CycC) is a Mediator kinase submodule cofactor-regulating transcription of genes involved in cardiac metabolism, energy homeostasis and stress response. In the current study, we demonstrate that CycC functions to also regulate mitochondrial dynamics. Our data shows CycC translocates to the cytoplasm in response to various stimuli in neonatal and adult rat cardiomyocytes (CMs). We also demonstrate that cytosolic expression of CycC alters mitochondria dynamics and function in vitro. Finally, as CycC is upregulated in humans with dilated cardiomyopathies, we developed CycC knock out (KO) and transgenic overexpression (Tg) mouse models, which have declined cardiac functions. These findings show that CycC is essential to maintaining normal mitochondria function in CMs. The overall goal of this project is to define the mechanisms whereby CycC functions in the heart by regulating mitochondrial dynamics in response to disease and/or cellular stress.

16 - Mackenzie Conlon

Major: Biomedical Sciences

Mentor: John Wemmie (Psychiatry)

Assessing the role of ASIC1A in cocaine self-administration in mice

Drug addiction is common, deadly, and often difficult to treat. A better understanding of the neurobiological mechanisms driving addiction and drug seeking is needed. Previous work has implicated acid-sensing ion channel-1A (ASIC1A) in both physiological and behavioral responses to drugs of abuse, suggesting a possible target for new therapies. ASIC1A is located throughout the brain in postsynaptic neurons and is activated by extracellular acidosis. Our previous studies with ASIC1A manipulations showed changes in cocaine-evoked behavior. *Asic1a*^{-/-} mice had increased cocaine place preference, while overexpression of ASIC1A in rats reduced cocaine self-administration. We hypothesized that *Asic1a*^{-/-} mice would have increased cocaine self-administration compared to wild types. *Asic1a*^{+/+} and *Asic1a*^{-/-} mice learned to press levers to receive intravenous cocaine, allowing them to control their own dose. This animal behavior is thought to most closely parallel human drug use. Preliminary findings suggested that wild-type and knockout mice had similar acquisition of self-administration. Interestingly, consistent with

our hypothesis, dose response challenges suggested that at lower doses *Asic1a*^{-/-} mice self-administered more cocaine than control mice. These results encourage future research into ASIC1A and brain pH. Further examination of their roles in drug craving and relapse could lead to promising breakthroughs and possible therapeutic targets.

18 - Jesse Cochran

Major: Chemistry, Biology, Biochemistry
Mentor: E. Dale Abel (Internal Medicine)

To go Keto, or not to go Keto: That is the question

Since the initial use of ketogenic diets (KD) as adjunctive treatment for epilepsy, these diets are being increasingly used to promote weight loss and to reduce the risk of metabolic sequelae of obesity. Typical KD are very low in carbohydrate and high in fat, promoting hepatic production of ketone bodies. Few studies have evaluated gender differences in response to KD, and many animal studies tend to be performed in male mice. To explore sex differences in response to KD, female and male wild-type mice on the C57BL/6J background were fed either a control diet (CD - 7% fat, 47% carb., 19% protein) or KD (75% fat, 3% carb., 8% protein), following weaning. Females on the CD manifested higher levels of circulating β -hydroxybutyrate (β -HB) than males (2.86-fold, p

20 - Zachary Dierks; Kierra Pauly

Majors: Anthropology, History; Anthropology
Mentor: James Enloe (Anthropology)

A Chip Off the Old Rock: The Identification of Raw Materials of Lithic Debris and Artifacts at Woodpecker Cave

A source location of raw materials for lithic technology yields important information about scale of mobility on the landscape by farmers of the Woodland period. A total of 382 pieces of lithic debris were analyzed from the archaeological site of Woodpecker Cave. Source materials were identified by comparison to a reference guide provided by the Office of the State Archaeologist. The proportions of those materials are compared for local and exotic raw material sources. These will be used to determine in situ manufacture of local products versus imported tools.

22 - Alayna Dieter

Major: Biochemistry
Mentor: Marcelo Correia (Internal Medicine)

Congenital skeletal muscle-specific DRP1 deficiency attenuates weight gain during high fat diet but does not alter glucose intolerance, energy expenditure or permeabilized skeletal muscle fiber respiration in female mice

Skeletal muscle (SM) of type 2 diabetics exhibit mitochondrial fragmentation and dysfunction, suggesting that inhibition of DRP1, a protein required for mitochondrial fission, might be explored therapeutically. We studied the impact of SM-specific DRP1 deficiency on systemic metabolism and SM fiber respiration.

We developed a model of congenital DRP1 deficiency in SM by crossing mice with DRP1 floxed alleles and those harboring myogenin CRE recombinase. DRP1 protein was reduced by 60% in SM of homozygous floxed female mice expressing myogenin CRE (KO mice). KO mice gained less weight during 10 weeks of high fat diet. No changes in glucose tolerance, energy expenditure and permeabilized skeletal fiber respirations were observed in KO mice.

SM-specific DRP1 deficiency reduces high fat-diet induced weight gain in KO mice without changing glucose intolerance, energy expenditure and permeabilized skeletal fiber respiration as compared with wild type animals. The lack of improved glucose tolerance despite weight gain resistance is puzzling but may reflect severe congenital insulin resistance at SM. We speculate that weight gain resistance in the setting of unaltered energy expenditure and skeletal fiber respiration in KO mice might be associated with adaptive myokines targeting distant organs like the adipose tissue and liver.

24 - Ethan Everhart

Major: History

Mentor: Alyssa Park (History)

Comstock, Comedy and Conservatism

This thesis investigates the policing of free speech through the lens of stand-up comedy. It argues that the passing of the Comstock Laws in the late nineteenth century influenced the way society thought about sexuality and obscenity, resulting in the numerous obscenity busts of Lenny Bruce, and the Supreme Court ruling in FCC vs Pacifica Foundation in 1977.

The Comstock Laws were the first federally enforced obscenity laws. They banned the mailing of anything sexual in nature: personal correspondence, erotic literature, sexual education pamphlets, certain

books, sex toys, and information on abortion. Their passage in the midst of numerous political scandals gave Congressmen a public crutch of morality but the laws would have social consequences for over a hundred years.

I explore Lenny Bruce and George Carlin because they are both seminal figures in stand-up comedy. Bruce came first and changed the way stand-up comedy was performed, breaking the taboo of talking about sex, politics and religion openly in public. For it, he was busted for obscenity numerous times in the early sixties, eventually leading to his death in 1966. Carlin took the place of the social comic after Bruce's death. He began talking about similar subjects, getting arrested numerous times and a routine of his was the centerpiece of a landmark Supreme Court case on free speech.

26 - Gwyneth Forsythe

Majors: Theatre Arts, History

Mentors: Jeffrey Cox (History), Lisa Schlesinger (Theatre Arts)

Girl Guides: Claiming a Place in the Public Sphere

This thesis investigates the Girl Guides, a British version of the Girl Scouts, who worked as messengers for MI5, the United Kingdom's counter-intelligence and security agency. Ages fourteen to sixteen, these ninety young women were trusted to deliver and keep military intelligence secrets that were so sensitive they couldn't be written down. Previous scholarship glossed over the work of young women during WWI, and has barely even taken note of the Girl Guides specifically. I could find two scholars, Tammy Proctor and Janie Hampton, who wrote about the work of Girl Guides during war times. However, they failed to extensively discuss the work of Girl Guides during WWI, focusing rather on WWII.

Research into Girl Guides and MI5 matters because it gives teenage girls, and the wider public, access to histories of women in wartime that have been overlooked by scholars in the past. The field of Women's History is relatively new, leaving large swathes of history unstudied, the Girl Guides of WWI are part of that. Reclaiming the very active roles and contributions to the war effort from young women in the past that have been eclipsed by the image of the passive, waiting women, would help young women and girls today to feel empowered and take an active role in their own communities.

28 - Jeremy Friedman

Major: Finance

Mentor: Thomas Rietz (Finance)

The Impact of Internal and External Factors on Logical Decision-Making

While human decision-making has been thoroughly studied in the past, little research has been performed exploring how differing degrees of incentive can impact logical reasoning. The purpose of this experiment was to study how well individuals could solve a series of logic problems while exposed to varying levels of monetary incentive and external influence. To this end, participants were presented with several Wason selection tasks. Each participant would receive various levels of feedback after each task, and their payment at the end of the experiment was either dependent or independent of their choices. The results showed that participants' answers tended to improve as the experiment progressed. Furthermore, while feedback was strongly tied to improved performance (i.e. "better" answers), participants whose payments were dependent of their answer choices were more likely to select the exact correct answer than those whose payments were independent of their performance.

30 - Christina Grimes

Major: Psychology

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

Changes in neuronal firing in the infralimbic cortex throughout cocaine self-administration, extinction and reinstatement

The rodent infralimbic cortex, a region of the medial prefrontal cortex, is necessary for the inhibition of cocaine seeking behavior. During cocaine taking (self-administration), this region is important for promoting cocaine seeking, however, when animals learn to withhold from cocaine seeking during extinction training, this brain region decreases cocaine seeking. Despite the importance of this region for modulating cocaine-seeking behavior, how neuronal activity within this region changes as animals learn to inhibit their cocaine-seeking behavior is unknown. This project aims to fill this gap in the literature by using in vivo electrophysiology to examine single unit activity in the infralimbic cortex as rats undergo cocaine self-administration, extinction training and reinstatement. We report that while there were no significant changes in the percentage of neurons modulated by behavioral events across

extinction training, we observed both an increase in neuronal bursting and in baseline firing rates as rats learn to withhold lever pressing during extinction training. These data help us better understand changes that happen in the brain due to chronic cocaine use. In addition to increasing our basic knowledge of how the brain works, these findings can be harnessed to better inform human therapies for drug abuse moving forward.

32 - Rebecca Hauser

Major: Speech and Hearing Science

Mentor: Inyong Choi (Communication Sciences and Disorders)

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.

34 - Nicole Hehr

Major: Ancient Civilizations

Mentor: Alexander Bassuk (Pediatrics, Neurology)

Activation of Microglia and Astrocytes in the Retina After Blast-Mediated Traumatic Brain Injury

Traumatic brain injury (TBI) causes about 30% of all injury-related deaths in the United States and those that survive suffer from permanent deficits including a range of visual dysfunctions. After the initial injury, ongoing inflammation causes tissue damage in the brain. As the retina is an extension of the central nervous system, we hypothesized that the retina would also experience inflammation after blast injury. We utilized a blast TBI (bTBI) mouse model to examine retinal inflammation after injury. A compressed air-driven shock tube system was used to expose mice to a blast pressure wave three times, simulating a repetitive injury. RT-PCR revealed increased inflammatory cytokines (IL-1a, IL-1B, IL-6, and TNFa) four hours post bTBI when compared to the shams. One-week post blast we observed morphological changes in microglia, indicating activation of the cells in response to injury. Additionally, astrocyte activation was seen throughout the retinal layers. This increase in retinal inflammatory cytokines in the acute period post injury could lead to the activation of pro-inflammatory microglia and astrocytes, which could be pharmacologically targeted to ameliorate the detrimental effects on vision.

36 - Rana Hewezi

Major: Philosophy

Mentor: Renata Pereira (Internal Medicine)

Resistance to Diet-Induced Obesity in Mice Lacking OPA1 in Fat Tissue Occurs Independently of Fat-Derived FGF21

Optic Atrophy 1 (OPA1) is a mitochondrial protein that regulates mitochondrial dynamics, respiratory capacity and crista integrity. The role of OPA1 in adipose tissue is incompletely understood. We generated mice lacking OPA1 in adipose tissue (OPA1 Ad-KO) and observed that these mice were resistant to diet-induced obesity (DIO), had increased energy expenditure and improved glucose. These changes were associated with increased adipose tissue and serum levels of fibroblast growth factor-21 (FGF21). We, therefore, sought to test whether fat-derived FGF21 mediated the resistance to DIO in OPA1 Ad-KO mice. We generated mice lacking OPA1 and FGF21 in adipose tissue by crossing mice floxed for OPA1 and FGF21 with mice harboring the CRE recombinase under the adiponectin promoter (DKO). DKO mice were placed on a 60% high-fat diet (HFD) or 10% control (Cont) diet for 12 weeks. DKO mice had reduced body weight and total fat mass after 12 weeks of high-fat feeding. Energy expenditure remained elevated, while food intake and activity were unchanged. The improvements in glucose

homeostasis observed in OPA1 Ad-KO mice were attenuated in DKO mice. In conclusion, adipose tissue-derived FGF21 is dispensable for the resistance to DIO observed in OPA1 Ad-KO mice, but may contribute to improved glucose homeostasis.

38 - Hannah Hildahl

Major: Human Physiology

Mentor: Kelly Messingham (Dermatology)

Antibody producing plasma cells are present in lesional skin of Bullous pemphigoid patients

Bullous pemphigoid (BP) is an autoantibody-mediated autoimmune disease. BP autoantibodies primarily target a skin attachment protein, known as BP180. Autoantibody binding to BP180 leads to its internalization, complement activation, and subsequent inflammation. This leads to loss of epidermal adhesion that manifests clinically as skin blistering. Antibodies are typically produced by B-cells in lymphoid organs, such as the spleen, lymph nodes and bone marrow. However, in the case of autoimmunity, antibody production can occur in other tissues. The goal of this project is to determine if B-cells or antibody producing plasma cells are found in lesional skin from BP patients. To achieve this, we obtained skin biopsies from BP patients and age/sex-matched controls, we placed thin (5-7 $\frac{1}{4}$ M) cryosections on glass slides, and then immunostained with fluorescently labeled antibodies specific for mature B-cells (CD19), plasma cells (CD138), and IgE antibodies. Images were captured with a Nikon photomicroscope equipped with epifluorescence and positive staining was analyzed with NIH ImageJ. Here, B-cells and plasma cells were elevated in lesional skin from patients with BP or pemphigus vulgaris (PV) another autoimmune blistering disease. However, IgE staining colocalized with CD19, but not CD138, suggesting that these autoantibodies are not produced locally.

40 - Jianwei Hu

Major: Biomedical Engineering

Mentor: Ernesto Fuentes (Biochemistry)

Mms Lys-R family transcriptional factor's 3-Hydroxypropionic acid(3-HP) binding site characterization

3-Hydroxypropionic acid(3-HP) is one of the important platform chemicals in the chemical industry. During chemical production, a biosensor for 3-HP concentration is needed for measuring the

concentration of 3-HP. Previous studies showed that MmsR Lys-R family transcriptional factor demonstrated the regulatory effect to the MmsA promotor. In this research, we are trying to find the binding site of 3-HP to MmsR protein. We obtained the computer model of the possible binding sites based on Phyre2 fold recognition tool and BLASTp result. We also harvested and purified the protein. The obtained protein sample went through titration and the fluorescence spectrum was recorded. We then compare the computer and spectrum result to find the exact binding site. The data obtained could be the guidance for future modification on the MmsR protein in order to increase the efficiency and speed of the regulatory effect.

42 - Qitong Jin

Major: Electrical Engineering

Mentor: David Andersen (Electrical and Computer Engineering)

Terahertz Continuum Generation in the LCS Lattice

Rabi oscillations in two-level Dirac systems have been shown to alter the frequency content of the system's nonlinear response. In particular, when considering Rabi oscillations in a quantum model beyond the semiclassical Boltzmann theory, even harmonics may be generated despite the centrosymmetric nature of these systems. This effect increases with increasing excitation intensity. In our present work, we extend the Rabi theory to a three-level Dirac system arising from a line-centered-square optical lattice. In this case, the Dirac cones are bisected at the Dirac point by a flat band that persists throughout the Brillouin zone. Due to the presence of this flat band, we expect a significant enhancement of the coupling between Dirac states, resulting in a large increase of the Rabi effects and their associated nonlinearities, leading to continuum generation of terahertz radiation.

44 - Abinav Jyotis

Major: Biochemistry

Mentor: Krystal Parker (Psychiatry)

Pharmacological manipulation of the rat cerebellar cortex at crus I disrupts performance in an interval timing task

Traditionally thought to be restricted to motor function, a growing body of work demonstrates that the cerebellum is crucial for cognition. A specific region of the cerebellar cortex, Crus I, has been shown in both humans and rodents to be involved in cognitive behaviors. Here, we use interval timing as a probe into the cognitive performance of rats. We used timing because the ability to estimate passage of time is a

cognitive process. Interval timing is impaired in both humans with neuropsychiatric illness (e.g. schizophrenia) and in rats with D1 dopamine-receptor antagonist SCH-23390 (SCH) infused in the medial frontal cortex (MFC). Using anterograde and retrograde tracing of Crus I and the lateral cerebellar nucleus (LCN), we established that Crus I is an extension of a “cognitive cerebellar circuit” from the LCN through the thalamus to the MFC. Crus I was pharmacologically manipulated in animals well-trained in an interval timing task, finding that GABA activation with muscimol disrupts timing and GABA inhibition with gabazine had no effect. However, when the MFC was inhibited by SCH, the simultaneous infusion of gabazine at Crus I rescued timing impairment, suggesting a therapeutic role for Crus I in disorders of frontal cognitive dysfunction.

46 - Vijay Kamalumpundi

Major: Human Physiology

Detergent based screening to discover components of the mitochondrial pyruvate carrier complex

The mitochondrial pyruvate carrier (MPC) imports pyruvate into the mitochondrial matrix, linking carbohydrate metabolism in the cytoplasm to metabolic activity in the mitochondria. The MPC is a protein complex consisting of subunits, MPC1 and MPC2. It is currently unknown whether other proteins that regulate the fate of pyruvate-derived carbon interact with the MPC. Due to the MPC's central role in the metabolism of sugars, we hypothesized that certain proteins differentially regulate MPC function based on cellular energy demand. Here we used a technique, called co-immunoprecipitation (Co-IP) to identify novel protein interactors with the MPC. To isolate the MPC complex, optimization of the IP protocol was required. By altering detergent conditions, we found that a 1% Digitonin concentration was sufficient to disrupt the membrane, release the protein and also preserve protein interactors. We next investigated protein interactions by performing pulldown assays in both fed and fasted mice. Results showed successful co-immunoprecipitation of two proteins from fasted liver extracts that act to shunt carbon away from catabolic processes. Our data suggest a model where these two proteins support carbon channeling toward the production of glucose in a fasted state by interacting with the MPC complex. This model will be furthered by salt screens and utilization of cross-linking reagents to elucidate protein complex interactions.

48 - Mila Kaut

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

Mentor: Leslie Schwalm (History)

The African Methodist Episcopal Church and Black Print Culture in Iowa

This project examines the role of the African Methodist Episcopal Church and Black print culture in shaping Black Iowans' conceptions of community, citizenship, and culture at the end of the nineteenth century. Through analysis of convention proceedings, sermons, literary pieces, and other material published in Black newspapers and periodicals, this thesis demonstrates how the relationship between the Church and print culture laid the ideological and organizational groundwork for the prominent race work organizations and activism of the twentieth century. This research identifies the significance of the discursive traditions and organizations established within churches and propagated by Black newspapers in constituting notions of liberation and networks of activism.

Focusing on churchwomen's roles as teachers, convention delegates, and organizers, as well as their dialectical styles as newspaper correspondents and authors, this thesis demonstrates how women constructed and leveraged claims to authority in Black public culture. It examines the gender conventions of the Church and identifies how women negotiated and transformed these in a dual effort to achieve visibility and to elevate the Church's institutional power. This thesis will argue that women's contributions in these arenas established the parameters and strategies of subsequent women's clubs, NAACP chapters, and other activist groups.

50 - Leo Kazma

Major: Human Physiology

Mentors: E. Dale Abel (Internal Medicine), Antentor Hinton (Internal Medicine)

Insulin stimulation increases ER-Mito contacts

Type 2 Diabetes is a disease that does not utilize insulin properly in the body. Type 2 Diabetes has been shown to have dysregulated specialized structures called Mitochondria Associated Membranes (MAMs). Inside the cell, two organelles come together through specialized regions called MAMs and these specialized membranes have proteins that act as glue to keep the mitochondria and endoplasmic reticulum together. In fact, MAM proteins that act like glue have been shown in the scientific

literature to aid in insulin stimulation and calcium transport. Therefore, to test if this is true, we made cells from isolated mouse tissue and treated the cells with insulin. After insulin stimulation, we utilized a method of protein detection called western blot to identify several MAM proteins, AKT, MTOR, and MFN-2. Next, we utilized an electron microscope to observe the events inside a cell. Visualization by this method is called ultrastructure analysis. Ultrastructure analysis showed that MAMs were closer after treating the cells with insulin. Together, these data suggest that insulin stimulation is important for keeping the glue between mitochondria and the endoplasmic reticulum working well in the cell.

52 - Ben Kirk

Major: Biomedical Sciences

Mentors: E. Dale Abel (Internal Medicine), Antentor Hinton (Internal Medicine)

Opa-1 Deficiency Promotes Muscle Atrophy Through Up-regulating ER-Mito Contacts and Autophagy

Type 2 Diabetes (T2D) is a disease that alters blood sugar to rise higher than normal. Notably, T2D has been associated with a decrease in muscle mass, decreased optic atrophy-1 protein (OPA-1), and a decrease in mitochondrial associated membrane formation. Mitochondrial associated membranes are specialized membranes that reside between mitochondria and the endoplasmic reticulum in a cell. These structures have proteins inside that recruit recycling machinery called autophagosomes. In the literature, a paper showed that loss of OPA-1 leads to muscle atrophy. Therefore, we hypothesized that loss of OPA-1 increases the amount of MAMs and recycling structures to promote muscle atrophy. To test this hypothesis, we removed OPA-1 using a specialized technology that acts like scissors, called Cre-LoxP in skeletal mouse muscle DNA and from cells that have been isolated from mouse muscle tissue. After removing OPA-1 from the DNA of our study animals, we were able to demonstrate that MAM and Autophagosome proteins increased. In cells, we were able to produce similar protein results and showed an increase in MAM and autophagosome structures. Together, this may suggest diabetic muscle atrophy may be due to the loss of OPA-1, increased recycle machinery, and increased MAMs.

54 - Samuel Kitzman

Major: Biochemistry

Mentor: Pamela Geyer (Biochemistry)

Understanding the role of Barrier to autointegration in a premature aging syndrome

Barrier to Autointegration Factor (BAF) is a highly conserved DNA binding protein that has roles in mitotic nuclear envelope reformation, chromatin regulation, and stem cell homeostasis. Stem cell homeostasis is altered when a single amino acid substitution is made in the BAF protein resulting in a progressive aging disorder termed NÃ©stor-Guillermo Progeria Syndrome (NGPS). To better understand how the NGPS mutation alters BAF function, we are studying *Drosophila melanogaster*, an organism that possesses a BAF protein 65% identical to human BAF. Using *Drosophila* allows us to conduct both in vivo and in vitro experiments to elucidate how BAF functions in cells and tissues. To test the in vitro properties of BAF, recombinant WT and mutant protein was grown up in bacteria and purified. Examination of the wildtype and mutant BAF through nuclear magnetic resonance (NMR) shows that the structure of the proteins is nearly identical, suggesting that the mutation causes a localized effect. In addition, we show the DNA binding capabilities of *Drosophila* BAF protein was markedly lower than human, suggesting that the DNA binding properties of BAF might play a less important biological role compared to other BAF interactors. Further exploring the various binding partners of BAF and their interactions will expand our understanding of how NGPS and other stem cell related disorders present themselves in humans.

56 - Jared Kowalski

Major: Finance

Mentor: Jeffrey Hart (Finance)

Outlook on the IPO market while market returns are on the rise

The decrease in the number of IPOs and alternative sources of capital for private and public companies. The past decade, the number of companies going public have been lower than prior periods. This paper will explore the reasoning behind going public and address potential concerns and reasons for why not as many companies are going public anymore.

58 - Ross Lanier

Major: Biochemistry

Mentor: Miles Pufall (Biochemistry)

Alternate splicing of LEF1 affects the treatment sensitivity of B-cell acute lymphoblastic leukemia

60 - Adrian Les

Major: Chemistry

Mentor: Johna Leddy (Chemistry)

Electrochemical Measurement of Polymer Compressibility

Compressible polymers are used in pharmaceuticals to achieve steady-state drug levels and other clinically desirable input rates. These input rates are dependent on the properties of the polymer, which requires that polymers be characterized prior to their optimization for drug delivery. Current methods of compressibility characterization rely on pressures 1,000-10,000 times that of atmospheric pressure and are unable to accurately measure low-pressure compression. Electrochemical methods are sensitive enough to measure changes in diffusion rates of electroactive species as they pass through a film. Through rotating disk cyclic voltammetry pressure is applied to the polymer film by the diffusing species as a function of rotation rate. The compressibility of the film can be measured as the volume change in response to this applied pressure. This work focuses on the diffusion of N,N,N',N'-tetramethyl-p-phenylenediamine (TMPD) through a polystyrene film, and the changes in the resulting voltammograms.

62 - Emma Lewis

Majors: Human Physiology, Medical Anthropology

Mentors: Mark Santillan (Obstetrics and Gynecology), Sabrina Scroggins (Obstetrics and Gynecology)

The Role of Steroidal Pathways in Placental Cell Migration

Preeclampsia, a hypertensive disorder of pregnancy, is the leading cause of maternal-fetal morbidity and mortality worldwide. Elevated arginine vasopressin (AVP) is predictive of and is sufficient to cause preeclampsia. Treatment of HTR-8/SVneo trophoblast cells with AVP results in trophoblast dysfunction. Betamethasone, a corticosteroid administered to prevent preterm birth complications, inhibits AVP and stimulates serum/glucocorticoid regulated kinase 1 (SGK1), a serine/threonine kinase. In the AVP mouse model of preeclampsia, early administration of betamethasone prevents preeclampsia. We hypothesized that betamethasone acts through SGK1 to inhibit the effects of AVP on trophoblast migration. HTR-8 trophoblast cells were untreated or treated

with AVP, AVP+betamethasone, AVP+SGK1 inhibitor, or AVP+betamethasone+SGK1 inhibitor. The ability of the trophoblasts to migrate (by measuring percent closure of 500mm gap) was assessed. As previously observed, AVP reduced trophoblast migration at 24 hours (Untreated: 58+/-2% vs AVP: 42+/-10%). Treatment with betamethasone (AVP+Betamethasone: 71+/-9%) improved trophoblast migration compared to AVP, however, this improvement was not reversed by inhibiting SGK1 (AVP+BMTZ+SGK1 inhibitor: 64+/-3%), as AVP+betamethasone+SGK1 inhibitor resulted in similar migration to untreated trophoblasts. Similar results were found at 48 hours. These data demonstrate that AVP inhibits trophoblast cell migration and that this can be reversed with betamethasone treatment, albeit through an SGK1 independent mechanism.

64 - Dacia Lipkea

Major: Biology

Mentors: Robin Bagley (Biology), Andrew Forbes (Biology)

Population structuring and phylogenetic inference in a species of tropical fly using double digest RAD markers

Blepharoneura (Diptera: Tephritidae) is a highly diverse, Neotropical genus of fruit flies that feed on cucurbit (Cucurbitaceae) host plants. Like most plant-feeding insects, Blepharoneura are highly specialized, with most species utilizing only a single part of one host species. Due to this extreme specialization and close, life-long associations with their host plants, shifts and subsequent adaptation to new hosts would be expected to drive divergence and diversification within the genus. However, sister species of Blepharoneura occupy extremely overlapping niches – they frequently share host plants and often utilize the same plant tissues. To investigate what role, if any, host use plays in driving divergence, we use double-digest restriction-associated sequencing (ddRAD-seq) to examine population structure and phylogenetic relationships between individuals of Blepharoneura species 10, which uses multiple host plants and parts throughout its range. Our findings show that, although the majority of divergence is linked to geographic location, host use may also contribute to differentiation.

66 - Ben Martin

Major: Health and Human Physiology

Mentor: Gary Pierce (Health and Human Physiology)

Endothelial Glycocalyx Microvascular Function in Human Preeclampsia

Preeclampsia is a cardiovascular disorder prevalent in 5-8% of pregnancies and is characterized by hypertension and protein in the urine. Its occurrence can have negative complications for both the mother and the fetus including but not limited to eclampsia (maternal seizures), premature delivery of the fetus, and organ damage. Recently, the ability to measure the microvasculature in other conditions has found microvascular impairments in chronic diseases such as aging, cardiovascular disease and renal disease. It is currently unknown if this impairment occurs in pregnancy or with the onset of preeclampsia. Microvasculature health can be assessed by measuring function of the glycocalyx, a protective layer of the luminal microvascular endothelium of arteries. The glycocalyx serves to regulate blood flow, flow resistance and stimulate release of nitric oxide, a potent vasodilator, in the microvasculature. Functional ability of the glycocalyx can be determined using the Glycocheck device that detects the lateral movement of red blood cells into the glycocalyx, known as the perfused boundary region. A greater perfused boundary region indicates diminished microvascular health. Therefore, we hypothesize that glycocalyx damage, expressed by a greater perfused boundary region, will be present in early to midpregnancy and in women that go on to develop preeclampsia.

68 - Caroline Meek

Major: English and Creative Writing

Mentor: Cate Dicharry (International Writing Program)

Creating Global Writing Communities

For the past two years, I've been working with teen writers around the world to create *Project Canvas*, a book of writing advice and inspiration. A community of writers came together to contribute their stories and expertise to the book, and this summer, we started the final stages of publishing. The book will be released November 15th, 2018!

After *Project Canvas*, I started thinking about the role of social media in creating creative communities, as that project was accomplished entirely through email, blogs, and social media sites. I researched the effects of social media on global writing communities and found that active use of social media (commenting, sharing, discussing) made individuals feel more connected with others, while passive scrolling had negative effects for the individual.

Near the end of the summer, I got to experience a global creative community in person through the International Writing Program's

Between the Lines summer writing camp. Here, I spent two weeks with high school-aged writers from Russia and Arabic-speaking countries. I was the official photographer and unofficial mentor and friend to the students. I reflected and wrote about the community that was built during those two weeks, through poetry and journal entries.

70 - Megan Merfeld

Major: Psychology

Mentor: John Freeman (Psychological and Brain Sciences)

The Role of the Prefrontal Cortex in Visual Categorization in Rats

Visual categorization is a learning and memory process that groups multiple objects together. Typically, categorization involves finding category relevant information (features that are exclusive to one category) as well as ignoring category irrelevant information (features that occur across categories). Finding these relevant features is thought to be a function of the Prefrontal Cortex (PFC) in humans. The current experiment examines the role of the PFC in category learning in rats. In this experiment, either the excitotoxin NMDA or saline was infused into the medial Prefrontal Cortex (mPFC) of male and female Long Evans rats. Then, rats were trained to discriminate artificial categories. Preliminary results have shown that compared to controls, mPFC lesioned rats were impaired on category tasks that contained category irrelevant features. These results suggest that the rodent mPFC is important for finding relevant information. Additionally, we conducted control experiments to ensure PFC inactivation does not produce other confounds, such as preventing the animal to learn the task's procedure or cause a loss in motivation.

72 - Madison Merfeld

Major: Biology

Mentors: John Wemmie (Psychiatry), Brian Dlouhy (Neurosurgery)

Evaluating the Role of ASIC1A in the Sedative Effects of Alcohol

Sensitivity to alcohol is a risk factor in the development of alcohol use disorder. Recent unpublished work in our laboratory suggests sensitivity to alcohol may be influenced by acid-sensing ion channel 1A (ASIC1A). ASIC1A is an ion channel activated by acid that is involved in synaptic transmission, and is expressed in brain areas involved in addiction. To evaluate the effects of ASIC1A on the effects of alcohol, we tested whether loss of ASIC1A alters the intoxicating effects of alcohol by assessing the righting reflex, a well-established effect of alcohol in mice, and also a novel intoxication behavior rating scale. We found that 2.5 g/

kg of alcohol causes a reduction in the righting reflex in both *Asic1a*^{+/+} and *Asic1a*^{-/-} mice; however, the *Asic1a*^{-/-} mice tended to recover the righting reflex more quickly. When we assessed intoxication severity by scoring the severity of the locomotor effects of alcohol, we found that *Asic1a*^{-/-} mice tended to take longer to reach alcohol induced immobility and spent less time severely intoxicated at this level. Together these data suggest ASIC1A contributes to the sedating effects of alcohol, and thus may contribute to the risk of alcohol use disorder.

74 - Jeremiah Meyer; Justin Rowell

Majors: Medical Anthropology; Ancient Civilizations, Anthropology

Mentor: James Enloe, Anthropology

Depth From Above: A photographic analysis of occupation levels and artifact frequency at Woodpecker Cave

We completed a photographic analysis of the woodpecker cave site. This was conducted through the use of digital media software. Mosaics of aerial photos were constructed for individual levels at 10 centimeter intervals. Individual artifacts were outlined to highlight spatial density of specific artifact types. This allows us to interpret where specific activities occurred.

76 - Cameron Moeller

Majors: History, International Relations

Mentor: James Enloe (Anthropology)

How it Went Down: Geospatial Analysis of Rockfall at Woodpecker Cave

The highest imperative in archaeology is not the acquisition of objects but the recording of spatial and associational relationships of those objects as they are removed from their original location. Critical to this analysis is the ability to locate these objects stratigraphically (their depth in the accumulated deposits of the cave). For this reason, the excavation of Woodpecker Cave includes precise three-dimensional recording of artifacts as well as limestone roof-fall blocks (geologically termed *boulis*) which form as the overhanging roof fragments and collapses from freeze/thaw conditions throughout the year. Using GIS (Geographic Information Systems) techniques, these recorded data are compiled into shape files in order to create a three-dimensional display within and between the artifactual materials from human occupations of the site. This display helps document the extent of occupation space within and in front of the shelter, and will be an essential basis for integrated analyses of the

sedimentary and artifactual fill of the stratigraphy of Woodpecker Cave. It will also be key to understanding shifts in the location of critical features, such as hearths, due to changes in the configuration of the rock shelter following episodes of roof collapse.

78 - Pooja Patel

Major: Biomedical Sciences

Mentor: Sarit Smolokove (Biology)

Analysis of replication protein A (RPA) complex consisting of rpa-1, rpa-2, and rpa-4 subunits and its roles in meiosis and double-stranded break repair

Meiosis is a specialized cell division used in all sexually reproducing organisms to generate gametes. During Prophase I of meiosis, crossover occurs, where homologous chromosomes exchange DNA. This exchange in DNA happens following the breakage of double-stranded DNA (dsDNA). Many proteins are involved in repairing these breaks. In *C. elegans*, the replication protein A (RPA) complex consists of rpa-1, rpa-2, and rpa-4 subunits. RPA was shown in other organisms to bind single-stranded DNA in order to prevent degradation of the DNA and the formation of secondary structures. This is required for downstream repair events, which includes the loading of the strand exchange protein RAD-51. DAPI staining and antibody staining allowed for the visualization of DNA and foci. As expected, deletion of rpa-2 resulted in the decrease of RAD51 foci compared to wild type. In contrast, rpa-4 mutants did not have a significant difference in numbers of RAD-51 foci compared to wildtype, indicating that rpa-2 may play a more significant role in dsDNA break repair than rpa-4. Analysis of rpa-4 foci showed increased numbers of foci when rpa-2 is absent. This may indicate that RPA-4 may be hindering the function of RAD51. Lastly, colocalization counts revealed significant colocalization between rpa-1 and rpa-2 subunit, suggesting they are part of one complex.

80 - Ashley Morris

Major: Geoscience

Mentor: David Peate (Earth and Environmental Sciences)

Elemental Compositional Analyses of Meteorites

The purpose of this project is to compile data on the elements that compose meteorites in order to be used in comparison with samples

whose visual characteristics could allow them to be interpreted as meteorites. The data compilation will serve to allow such samples to be analyzed and quickly determined if they are in fact extraterrestrial or terrestrial. The elemental composition of known meteorites is being analyzed with X-ray fluorescence, collected and recorded by a pXRF in weighted percentages. The samples are tested twice, once on Alloy Plus Mode and once on Geochem Mode in order to collect data on metal and nonmetal element percentages. Each sample is tested in two positions per exposed surface; an exposed surface referring to the outside of the rock or inside if it has been cut. There are three analyses run per position to maximize accuracy. Terrestrial samples with visual characteristics of meteorites will also be tested to compile a data set of common elements found in them per type of meteorite they resemble. Extraterrestrial rock is comprised mostly of nickel and iron, with iron composition often exceeding 50% and nickel composition ranging from 5-10%. Elements not found in extraterrestrial rock often include copper, tin, and zinc among others. This knowledge and data allow for a clear justification in differentiating meteorites from terrestrial rocks based on the elements a sample contains. The compiled data could be used as a guide in the field.

82 - Marissa Mueller

Major: Biomedical Engineering

Mentors: Laura Frey-Law (Physical Therapy and Rehabilitation Science), Ruth Chimenti (Physical Therapy and Rehabilitation Science)

Assessing Objective Estimates of Physical Activity: Variations in Actimetry Outputs using ActiGraph

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 population, researchers rely on clinical-grade accelerometers and software platforms such as ActiGraph to quantify PA. Despite technological advances, a lack of standardization in converting raw accelerations to useful measures of step counts, energy expenditure (EE) and time spent in moderate-to-vigorous-activity (MVPA) remains problematic; the specific effects of data-filters and algorithm options within Actigraph on PA estimates is 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 Accelerometer on the wrist for one week was analyzed using combinations of 3-5 algorithms, the low-frequency-extension, and the wrist-worn specification for each metric. Large variations in PA estimates

between methods were observed for EE (83%) and MVPA (100%) without effecting step counts. The LFE extension only notably impacted step outputs (40%), whereas wrist options largely influenced MVPA (100%) and EE (44%) estimates. Although the methods examined have been previously validated, they are not interchangeable, indicating that exact measures of PA are highly dependent on employed analysis specifications.

84 - Timothy Nguyen

Major: Biology

Mentor: Songhai Chen (Pharmacology)

Identification of novel tumor suppressors in estrogen receptor positive breast cancer by an in vitro/in vivo genome-wide CRISPR screen

Over 75% of breast cancers are classified as estrogen receptor-positive (ER+). Adjuvant endocrine therapies (ET) such as tamoxifen have revolutionized treatments for breast cancer patients. However, resistance to ET's are commonly reported and serves as a significant issue in optimal clinical management. The molecular mechanisms of acquiring ET resistance is still largely unknown, making approaches in combating resistance limited. Using MCF7 cells, an ER+ cell line, and a genome-wide CRISPR-Cas9 knockout (GeCKO) library, an unbiased and unique in vitro/in vivo combination screen was performed for tumor suppressors involved in tumor progression, estrogen independence, and tamoxifen resistance. With a list of top hits from MCF7 cells first selected with tamoxifen treatment and injected into nude mice, single CRISPR knockouts (KO) lines were generated and injected in vivo once more. Two gene KOs, of NEGR1 and NFKB1, showed the largest tumor formations and reformation after tumor removal, and chosen to further characterize. So far, downregulation of either NEGR1 or NFKB1 showed greater cell growth and resistance to tamoxifen. Most of the genes on the list are already implicated as tumor suppressors, and remainders have not. Thus, the results have identified novel determinants in tumor progression and ET resistance in ER+ breast cancer.

86 - Mara O'Connor

Major: Human Physiology

Mentors: Hanna Stevens (Psychiatry), Jessica DeWitt (Psychiatry)

The relationship between the autism-associated BCKDK gene with behavioral performance and neuronal activity in the caudate putamen

Introduction: The branched chain ketoacid dehydrogenase kinase (BCKDK) regulates the branched chain ketoacid dehydrogenase, which metabolizes branched chain amino acids (BCAAs). Loss of function mutations in BCKDK leads to over-catabolism of BCAAs and increases in oxidative stress. Mutations in BCKDK have been found in patients with autism spectrum disorder (ASD) with epilepsy. MRI of BCKDK knockout mouse brains found greater caudate putamen volume than wild type mice. The impact of BCKDK on behavior is unknown. Methods: To determine behavioral changes in BCKDK knockouts, mice were tested by rotarod. Rotarod measures procedural learning associated with caudate putamen. Brains were examined through immunohistochemistry using c-Fos stain to compare active cells. Results: Stereology revealed active neuron caudate putamen density to be greater in mutant females than wild type. However, this difference was not statistically significant. Mutant mice had statistically significant higher learning coefficients than the wild type on the rotarod. Conclusion: These behavioral changes are not significantly associated with an increase in the density of active caudate putamen neurons in female mice. However, in caudate putamen of male mice previous data showed an increase in density for male wild type mice. These differences suggest that the mechanism for this behavior varies between sexes.

88 - Ryan Reis

Major: Biomedical Sciences

Mentor: David Soll (Biology)

266 Monoclonal Antibodies Screened For Blocking Activity of Breast Cancer, Melanoma and Glioblastoma Cell Aggregation in a 3D Matrigel Model Reveals A Central Role for Integrin α -3 β -1

Breast cancer, melanoma and glioblastoma cells undergo cell-mediated aggregation and aggregate coalescence in a transparent 3D Matrigel environment. Cells from normal tissue and nontumorigenic cell lines do not exhibit these behaviors. Here, 266 monoclonal antibodies (mAbs) demonstrated to interact with a wide variety of membrane proteins, secreted proteins and matrix proteins, have been screened for their capacity to block these tumorigenic cell-specific behaviors in a transparent Matrigel 3D environment. Remarkably, only six of the 266 tested mAbs exhibited blocking activity, four targeting integrin β -1, one targeting integrin α -3 and one targeting CD44. Colocalization of integrins α -3 and β -1 in fixed cells, and live aggregates in a 3D environment, suggests that the integrin α -3 β -1 dimer plays a central role in cancer cell aggregation in the 3D environment provided by Matrigel, a basement membrane derivative.

90 - Marissa Roseman

Majors: Biology, Environmental Science

Mentor: Maurine Neiman (Biology)

Do parasites help drive life history variation in natural populations?

Different organisms use a variety of life history strategies, and disease-imposed natural selection should influence the evolution of these critically important traits. We aim to address whether variation in selection imposed by a parasite disease can explain striking variation in life history traits in *Potamopyrgus antipodarum*. This New Zealand freshwater snail is characterized by wide variation in life history traits and spatial variation in infection frequency by a sterilizing parasite, *Microphallus livelyi*. Founding females field-collected from three high-infection lakes/habitats and five low-infection lakes/habitats were isolated in cups and checked weekly for G1 offspring. G1 females were photographed and measured weekly to determine growth rate and checked weekly for G2 offspring to determine the time until reproductive maturity, and size at maturity was measured. Results suggest that earlier reproduction is associated with a faster growth rate, while time until reproductive maturity was not strongly correlated with adult size. Data showed a strong influence of lake of origin on life history values, far more so than level of infection. This suggests local adaptation and/or neutral population divergence may be contributing more than disease to life history variation. It poses the question: what sort of costs may be associated with rapid growth and earlier reproduction that encourage the persistence of variation?

92 - Mitchell Schaffer

Major: Biomedical Engineering

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

Modeling Muscle Fatigue: Identifying Fatigue Behavior with Limited Data

Muscle fatigue is a risk factor for musculoskeletal injury, yet remains relatively difficult to predict. Mathematical models have been developed to represent muscle fatigue, however, only generalized parameter values that define average fatigue behavior have been identified. It remains unknown how much data is required to identify stable, accurate parameters for the individual level. Thus, the purpose of this study was to determine the effect of number and location of fatigue data points on optimized parameter values using previously published data. Twenty datasets met our inclusion criteria: isolated muscle fatigue tasks with intermittent rests, and ≈ 8 maximum voluntary contractions (MVCs)

reported to monitor force decay. Four versions of each dataset were used to identify optimal fatigue (F) and recovery (R) parameter values for a mathematical fatigue model using numerical methods. The F and R values were compared across the four versions: all reported MVCs (V0) and three using only half of the MVCs (V1, V2, V3). Repeated measures ANOVAs demonstrated reduced MVC data tended to result in higher F and R parameter values, weighting the datasets by sample size. However, estimates were least altered when fatigue data (MVCs) were from the beginning and end of the fatiguing task.

94 - Hayden Schultz

Major: Business Analytics, Finance

Mentor: Leslie Flynn (John Pappajohn Entrepreneurial Center)

STEM Innovator™: Portfolio Assessment of Innovation, Invention & Entrepreneurial Skills and Mindsets

The STEM Innovator Portfolio tool measures how students' innovation, invention & entrepreneurial skills and mindsets change as a result of engagement in the process of innovation. Students work in teams collaborating with community partners to demonstrate competencies through authentic tasks similar to those expected in career settings and post-secondary education. The portfolio includes six items collected a minimum of three times across the course of the innovation process. Data was collected on 360 high school students across a minimum of 14 weeks. The Innovator Profile measures 34 different skills and mindsets which significantly grew across the project ($P < 0.001$) as did students collaboration and team problem solving skills measured with the Team Value Rubric ($p < 0.001$). Pitch Scores also significantly increased ($p < 0.001$) as measured by feedback forms and video analysis. The STEM Innovator Canvas® provides a snapshot of team progress through data to support claims, partnerships and sustainability potential. Content analysis shows advancement of complexity in projects across time. Students also submit a proficiency exam covering topics in engineering design, scientific practices and entrepreneurship. Students can use their portfolio for college admission, scholarship applications. Portfolio submissions offer an alternative and a more complete view of student competencies than just a traditional proficiency exam.

96 - Nicholas Shaw

Majors: Biochemistry, Psychology

Mentor: Lori Wallrath (Biochemistry)

LINCing the nucleus and the cytoplasm in muscle

Dominant and recessive mutations in the human gene SYNE1 cause diseases such as myopathy. SYNE1 encodes a KASH-domain protein called Nesprin, a component of the LINC (Linkers of the Nucleoskeleton and Cytoskeleton) complex. Nesprins span the outer membrane of the nuclear envelope and interact with cytoskeletal proteins and with SUN-domain proteins in the perinuclear space between the inner and outer nuclear membranes. SUN-domain proteins interact with lamins, filamentous proteins that line the nucleoplasmic side of the inner nuclear membrane. Thus, the LINC complex connects the cytoskeleton to the nucleoskeleton. To understand how mutations that alter the LINC complex affect muscle, we took advantage of genetic tools available in *Drosophila* (fruit flies). *Drosophila* has two Nesprin-like proteins called Msp300 and Klarsicht, and a SUN-domain protein called Klaroid. RNAi was used to knock-down levels of each protein in muscle and immunohistochemistry was used to examine cellular defects. Knockdown of Klarsicht and Msp300 caused reduced nuclear migration and loss of microtubule organization. In addition, knock-down of Msp300 caused reduced viability. Knock-down of Klaroid resulted in myonuclear chromatin protrusions, suggesting a weakened nuclear envelope. Thus, loss of LINC complex proteins disrupts coupling between the cytoplasm and nucleus, providing a possible mechanism for human muscle disease.

98 - Phoebe Snydersmith

Major: Psychology

Mentor: Teresa Treat (Psychological and Brain Sciences)

Effect of Normative Feedback on College Women's Self-Evaluations

Recent research in our lab has documented marked individual differences among college and community women in what they report impacts their self-evaluations, with body shape and weight having a stronger influence on the self-evaluations of women with eating- and weight-related concerns. Moreover, college women display normative misperception of what influences the average college woman's self-evaluation. College women overestimate the extent to which body shape, facial attractiveness, and romantic relationships influence the average college woman's self-evaluation, and they underestimate the extent to which intelligence, family relationships, and being a good person do. Studies unrelated to eating- and weight-related concerns have shown that presenting participants with accurate information about

social norms (i.e., normative feedback) can motivate behavioral change (e.g., reducing alcohol consumption and risky sexual behavior among college students). Thus, the current work examines the impact of normative feedback about what really influences the average undergraduate woman's self-evaluation versus the participant's perception of what influences the average undergraduate woman's self-evaluation. We expect that participants who receive normative feedback will be more motivated to change what affects their own self-evaluation than participants who do not.

100 - Andrew Textor

Major: Chemical Engineering

Mentor: Aju Jugessur

Correcting for Electron Scattering in Thin Polymer Films to Improve Nano-scale Devices Fabricated Using Electron Beam Lithography

Photomasks used to create transistors on a chip are almost exclusively fabricated using electron beam lithography (EBL) due to the tight design specifications¹. One limitation of EBL is electron scattering across the surface of the substrate. Certain patterns fall victim to high or low amounts of electron scattering and cannot be discerned from those that were directly written. Layout BEAMER is a commercial software package used in industry to correct for electron scattering in EBL processes. Many researchers use proximity effect correction (PEC) to improve their patterning, but the resolution limits of PEC have not been evaluated^{2,3}. This research investigates how PEC can be applied to reliably improve complex geometries. After BEAMER adequately corrected for long range electron scattering to improve shape fidelity of isolated features but failed to improve resolution of fine, dense features. Correcting for short and longrange electron scattering drastically improved resolution for both dense and isolated features. Using these techniques, critical dimensions for the final device were improved from 37.8 ± 10.2 nm to 12.6 ± 6.0 nm. Using PEC, the resolution is only limited by process blur.

102 - Jacob Thompson

Major: Biomedical Engineering

Mentor: Kristan Worthington (Biomedical Engineering)

Microstructured, Photopolymerized Chitosan-PEG Hydrogels for Retinal Tissue Engineering

Retinal degeneration is one of the leading causes of blindness and because retinal cells cannot regenerate, generating replacement cells using induced pluripotent stem cells is a hopeful option to restore sight. However, these new cells require a support scaffold and precise architectural cues to survive and become correctly oriented before transplantation. Furthermore, controlling the scaffold stiffness to match the low modulus of the retina increases the chance of scaffold success. In this study, chitosan was blended with polyethylene glycol to make photoreceptor cell scaffolds. PEG-Chitosan scaffolds were fabricated via UV photopolymerization, with a photomask to direct scaffold microstructure. The polymerization threshold was determined at five exposure points, each with a unique stiffness. Immortalized retinal progenitor cells (RPCs) were seeded onto these scaffolds and their growth was monitored using confocal microscopy. While cell growth was only detected on a small fraction of samples, likely due to imperfect seeding methods, the cells that did attach to the scaffold were viable and retained RPC markers. Future studies will focus on studying cell-material interactions using scaffolds created at low light intensities, which were cleaner than the other scaffolds. Our work helps elucidate how best to optimize the structural, mechanical, and biological properties of retinal scaffolds, making photoreceptor therapy more tangible as a cure for retinal degeneration.

104 - Brandon Toth

Majors: Neuroscience, Biochemistry

Mentor: Huxing Cui (Pharmacology)

The Role of Lateral Hypothalamic Leptin Receptor Signaling in Metabolic Regulation and Behavior

While it has been known that heterogeneous groups of neurons in the lateral hypothalamic area (LHA) play an important role in maintaining metabolic homeostasis, the mechanisms by which these neurons sense peripheral metabolic cues and carry out homeostatic behaviors affecting metabolic functions are incompletely understood. In present study, we examined the role of lateral hypothalamic leptin receptor (LepR)-expressing neurons - a subset of LHA GABAergic neurons that are distinct from well-known orexin and MCH neurons - in metabolism and behavioral regulation. Using a viral-mediated Cre-LoxP system, we deleted LepR specifically from the LHA and found that loss of LepR signaling in the LHA induces a reduction in both body weight and locomotor activity, as well as dark phase-specific increase in sleep when fed high-fat high-sugar diet. Consistent with reduced locomotor activity and disrupted sleep pattern, we further show that LepR deletion in the

LHA markedly decreases orexin expression level, indicating that active LepR signaling in the LHA is crucial for maintaining orexin expression. Despite the apparent loss of orexin signaling, mice lacking LepR specifically in the LHA exhibit increased motivation to work for palatable sugar pellets, as tested in an operant responding behavioral paradigm. These findings identify the LHA as a key site where adipocyte-derived metabolic hormone, leptin, acts to control homeostatic behaviors likely through the modulation of orexin signaling.

106 - Michael Westphal

Major: Human Physiology

Mentor: Renata Pereira (Internal Medicine)

OPA1 Deficiency in Brown Adipose Tissue Prevents Diet-Induced Obesity and Insulin Resistance

Optic Atrophy 1 (OPA1) is a mitochondrial protein that regulates mitochondrial dynamics and function. Normal mitochondria function is critical to maintain the appropriate balance between energy storage and expenditure in adipocytes. Particularly in brown adipocytes, proper mitochondrial function is required for adequate thermogenic activation. However, the role of OPA1 and mitochondrial dynamics in brown adipose tissue (BAT) physiology is incompletely understood. In the present study, we sought to test the hypothesis that OPA1 is required for the physiological adaptations of BAT to diet-induced obesity (DIO). We generated mice lacking OPA1 specifically in BAT by crossing mice floxed for the *Opa1* (OPA1 BAT-KO) gene with mice harboring the Cre recombinase under the control of the UCP1 promoter. To test the role of BAT OPA1 in the adaptation to DIO, we fed OPA1 BAT-KO and wild type (WT) mice either a 60% high-fat diet (HFD) or 10% fat control diet (Cont) for 12 weeks. As expected, mitochondrial respiratory capacity was reduced in BAT mitochondria isolated from KO mice. However, mitochondria respirations were elevated in the inguinal fat pad of these mice, which correlated with increased UCP1 protein levels, suggesting browning of white adipose tissue. Surprisingly, OPA1 BAT-KO mice were completely protected from DIO, as demonstrated by preserved body weight and fat mass relative to WT mice.

108 - Alexis Williams

Majors: Biology, Anthropology

Mentor: Lara Noldner (Office of the State Archaeologist)

Analysis of Pathologies in the UI-Stanford Osteological Collection

The UI-Stanford Osteological Collection (UI-SC) located at the Office of the State Archaeologist represents approximately 1100 individuals who lived in the San Francisco Bay Area in California from the 1800 to early 1900s with only 230 of the individuals having associated records. In this study, 159 individuals without documentation were fully analyzed with the goal of identifying the most prevalent pathologies and their skeletal distribution. A total of 133 individuals had one or more of 15 determined pathologies. These pathologies range from cases of porotic hyperostosis, accounting for 1% of the pathologies in the collection, periostitis, accounting for 7% of the pathologies, trauma, accounting for 12% of the pathologies, and degenerative joint disease (DJD), accounting for 30% of the pathologies. DJD cases were then broken down by osteological element and their respective joint surfaces. The os coxa, femur, and tarsals exhibited the highest amounts of DJD overall in the combined male and female samples. These results are comparable with pathological studies conducted on other osteological collections in the U.S., such as the Hamann-Todd, and increase the amount of available information for researchers on a subset of the individuals in the UI-SC without documentation..

110 - Mikayla Wymore

Majors: Chemistry, Biochemistry

Mentor: Scott Daly (Chemistry)

Synthesis, Characterization, and Ligand-Centered Reactivity Studies of Cu(I) Complexes with Triaminoborane-Bridged Diphosphines

Transition metal complexes with boron-containing ligands have shown interesting reactivity with small molecules or catalytic reactions. Triaminoborane-metal complexes, however, have not been studied a lot due to the reduced Lewis acidity, especially in the absence of M-B direct interactions. In this research, two phosphine-triaminoborane ligands (PhTBDFos and OMeTBDFos) were prepared by modifying the previously reported ligand backbone called 1,8,10,9-triazaboradecalin (TBD). Metal coordination with CuCl successfully formed (PhTBDFos)CuCl and (OMeTBDFos)CuCl complexes, which were confirmed by single crystal X-ray diffraction (SC-XRD), multi-nuclear Nuclear Magnetic Resonance (NMR), and Ultraviolet-visible (UV-vis) spectroscopy. Highly-fluorescent (PhTBDFos)CuCl showed green emission in both solid and solution. The addition of MeOH formed MeOH-bound complex and its fluorescence turned blue. (OMeTBDFos)CuCl complex, however, did

not show any fluorescence and crystal structure was a complex salt due to the effect of phosphine substituents (Ph vs. OMe). Chloride ligands in both complexes were replaced with S2CNEt2 to stabilize Cu metal centers. The reactions of (PhTBDPhos)Cu(S2CNEt2) and (OMeTBDPhos)Cu(S2CNEt2) with MeOH formed either a decomposed product or MeOH-bound complex.

112 - Alexandria Yakes

Majors: Ethics and Public Policy

Mentor: Marina Zaloznaya (Sociology)

Is White Collar Crime White? Racialization of Offenders in Print Media

For this project, we are investigating rates of individualization among black and white offenders in American print media from 1950-1989. Beginning in the 1960s, American crime policy began to shift from an emphasis on financial crime to an emphasis on street crime. Street crime was touted as the more pervasive threat to society while white-collar crime was seen as necessary for a functioning capitalist society. Simultaneously, street crime began to be racialized by the American media. African American offenders have experienced low levels of individualization in street crime reporting when compared to white offenders, which in turn has created a "criminal black class." From this historical context, we derived two hypotheses. First, black and white perpetrators of white-collar crime are portrayed more similarly in terms of individualization before 1975 than after 1975. Second, black white-collar offenders are more individualized than white offenders in print media. At .05 significance level, three variables are statistically-significant predictors of individualization: race of the offender, the date of the publication, and whether a victim of the crime is described. This finding expands our understanding of white-collar crime reporting and demonstrates the pervasiveness of racial bias in American society

114 - Lucee Laursen

Major: Ethics and Public Policy

Mentor: Takis Poulakos (Rhetoric)

Ethics in Eminent Domain

The primary objective of this study was to assess the ethics of using economic development as an element of a valid argument to satisfy the public use clause of the fourth amendment. Public use has been redefined by the U.S. judicial branch throughout the entirety of eminent domain's life. In redefining and reinterpreting what constitutes 'public

use' the courts have swayed back and forth between individual rights and what is best for the public. In recent years, the pendulum has swung towards the betterment of the public and in doing so, unwanted consequences have emerged. In *Kelo vs the City of New London*, a court case heard by the Supreme Court in 2005, the court defined economic development as a valid application of public use. Soon after, the Pfizer pharmaceutical company, the beneficiary of the land at stake in the *Kelo* case, lost a significant amount of money. Subsequently, acres of land that were once occupied by hundreds of citizens and families currently sit vacant. Despite what everyone, including the Supreme Court, believed to be a foolproof plan for economic development of a community, the proposed expansion of the Pfizer pharmaceutical plant fell through. This substantial loss of land, money and community trust is exactly what can happen when the judicial branch allows government entities to use economic development as a reason to use their power of condemnation of land. No one can promise economic development, *Kelo* proves that. Thus, I concluded that economic development is never an ethical reason that government entities should be able to use in their fight to justify their use of eminent domain.

