

**The 9th Annual**



**Fall**

**Undergraduate**

**Research**

**Festival**

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

University of Iowa  
University Capitol Centre  
2<sup>nd</sup> floor South Atrium  
Iowa City, Iowa

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

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

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The 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

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

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### 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*

Mitochondria, the power houses of cells, are fragmented and dysfunctional in skeletal muscle of diabetic patients. Mitochondrial fragmentation suggests that the activity of the protein responsible for mitochondrial division (that is, DRP1) is elevated in diabetics and, thus, might be a therapeutic target. We developed a mouse model of depletion of DRP1 in skeletal muscle [that is, knock out (KO) mouse]. KO mice were resistant to weight and fat mass gain during fatty diet, which was associated with improved tolerance to glucose and increased energy expenditure. The secretion of hormones by the muscle (that is, myokines), FGF21 in particular, might help explain the metabolic effects in KO mice with depleted DRP1 in skeletal muscle. Reduction of mitochondrial fragmentation in diabetics can potentially be of therapeutic value.

### 3 -Maeve Bittle

Major: Environmental Engineering

Mentor: Rachel Marek (Civil and Environmental Engineering)

Airborne PCB sources to people living near PCB-contaminated waterway

This project will determine airborne levels of polychlorinated biphenyls (PCBs) inside and outside homes in urban East Chicago, Indiana. PCBs are a persistent and toxic pollutant commonly found in sediment, water, and air around the world. The homes in East Chicago 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 in homes include house paint and some old window caulking and light ballasts. Air samples were collected before and after dredging started. The questions to be addressed by this project are:

1. What is the effect of dredging on PCBs in home air? 2. Are there other PCB sources in these homes, and what are they? Thirty samples collected before dredging started were previously analyzed. Although one larger scope of this project is to compare pre- and post-dredging samples, this poster highlights the 24 of 60 postdredging 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. The gap in literature about pathogen persistence in soil needs to be addressed. In order 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 E.coli (ETEC) since it is a common water and soilborne pathogen that causes disease. To better understand how pathogens survive in the soil we will put known amounts of ETEC into beakers of Kenyan soil in the terrarium. Then, we will sample the soil from those beakers over time. We will then perform quantitative PCR which allows us to see how much soil survived over time. Eventually, we will repeat this experiment with other dangerous pathogens.

This experiment has never been done before and will help narrow the gap in research regarding pathogen persistence in soil over time. The results from this experiment will help increase the understanding of 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 Neurodevelopment of Offspring*

Preeclampsia, a gestational disorder characterized by hypertension and excess protein in the urine, affects about 5 to 10% of pregnancies. It is associated with various pregnancy complications and an increased risk of neurodevelopmental disorders in offspring. To model preeclampsia in mice, we insert a pump that continuously releases vasopressin (AVP), a hormone that is elevated in human preeclampsia and is sufficient to cause the characteristics of preeclampsia, throughout gestation, into female mice three days before mating. After looking at 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 embryonic AVP mice but not in adults. In addition, we have found that the cell number remains the same in the embryonic brain, but that density is increased to accommodate for the volume difference. 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*

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

mechanisms involved. Mitochondrial dynamics has emerged as an important mechanism to maintain cardiomyocyte integrity. This study will investigate the importance of balanced mitochondrial dynamics in maintaining cardiac function.

### **15 - Brandon Cooley**

Major: Biology

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

#### *Treatment of Preeclampsia: The Role of Aspirin in Gene Expression*

Preeclampsia is a disorder during pregnancy characterized by excessive protein excretion, high blood pressure, and swelling of the hands and feet. It affects 5-7% of all births, and is thought to be influenced by both environmental and genetic factors. Much about the disease, such as the mechanisms involved in how it occurs, is still unknown. The only preventative treatment is low dose aspirin that seems to help lessen the severity of the symptoms. In this experiment, we grew placental cells in wells for 48 hour intervals after either being treated with aspirin or without aspirin. We then isolated the RNA from these cells, and ran them in a microarray with placental tissues obtained from the Maternal Fetal Tissue Bank that would measure the changes of gene expression in cardiovascular related genes. The placental samples obtained were placed into 4 different groups: preeclamptic women who took aspirin during pregnancy and women who didn't, and non-preeclamptic women who took aspirin during pregnancy and women who didn't. The results showed increased expression in many genes in preeclampsia and this expression was reduced with aspirin

### **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 High Blood Pressure Related to Pregnancy on Vasopressin Receptor Expression*

Preeclampsia is characterized by high blood pressure during pregnancy which can lead to complications during and after pregnancy. It has already been discovered that having preeclampsia or chronic hypertension while pregnant can lead to cardiovascular problems in the future for both the mother and baby. Vasopressin is a hormone that regulates blood pressure and has been shown to play a role in the development of preeclampsia. Vasopressin has three main receptors AVPR1a, AVPR1b, and AVPR2 along with three other receptors OXTR, LNPEP, and CUL5. In a previous study we used umbilical cord blood cells to determine how pregnancy-related factors such as sex of the baby and gestational age at delivery would affect the expression of the vasopressin receptors. This study aims to investigate the expression of the vasopressin receptors in women with chronic hypertension and preeclampsia. In children born to women with chronic hypertension we discovered that the AVPR2, LNPEP, CUL5, AVPR1, and OXTR were all expressed significantly lower when compared to children born to women without chronic hypertension. The samples from children born to women with preeclampsia had significantly lower expression of AVPR1a, AVPR1b, AVPR2, and OXTR when compared to non-preeclamptic 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*

Brookhaven National Laboratory is home to the Relativistic Heavy Ion Collider (RHIC) and A Toroidal Large Hadron Collider (LHC) Apparatus (ATLAS) Computing Facility (RACF). The RACF computing clusters are configured with Puppet, an open-source software configuration management tool. Puppet allows for software to be configured centrally across a heterogeneous network of server nodes. Using Puppet, one can centrally manage the four applications that make up the Elastic Stack; Elasticsearch, Logstash, Kibana, and Beats. The Elastic Stack allows for streamlined data processing, searching, and visualization. Installation of the Elastic Stack at the RACF will allow logging data to be easily processed. The ability to organize and visualize logging data is crucial for tracking patterns in system operation, allowing for quicker incident response. This stack was installed on a total of five different nodes; three nodes form an Elasticsearch cluster, one hosts Logstash, and one hosts Kibana. Looking ahead, it may be possible to feed this data into machine learning algorithms to train them to recognize issues faster and more efficiently than staff.

### **23 - Julianna Feracota**

Majors: Accounting, Dance

Mentor: Cristi Gleason (Accounting)

## *Impact of New Revenue Disclosure Requirements*

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*

By activation of the Endogenous BMP2 in human cells, we could use less BMP2 protein to promote bone regeneration. This would reduce the side effects of excess amount of BMP2, which will have a really practical clinical result.

## **27 - Morgan Hardiman**

Major: Business Analytics and Information Systems

Mentor: Jeffrey Ohlmann (Management Sciences)

*Analysis of NFL Viewership Ratings*

In my exploration, I am analyzing the viewership ratings for the primetime National Football League (NFL) games during a season. As one of the largest brands in both the United States and the world, the NFL is still trying to perfect their schedule by nationally broadcasting the best game to maximize their views each week of the season. I will conduct multiple analyses regarding which factors will bring more viewers and which factors keep potential viewers from watching the game. Also, further analysis will be completed to predict the viewership rating for a specific game based on these factors and identifying which games will likely have extremely low or high ratings.

## **29 - Cameron Hauser**

Major: Human Physiology

Mentor: Gordon Buchanan (Neurology)

*The involvement of the locus coeruleus in waking up in response to CO<sub>2</sub>*

Waking up in response to increased blood CO<sub>2</sub> is an important ability that prevents CO<sub>2</sub> from building up to harmful levels. Dysfunction in this ability may be involved in conditions such as sudden unexpected death in epilepsy and sudden infant death syndrome. Individuals affected by these conditions do not wake up in response to increased CO<sub>2</sub> levels resulting in death. Despite the importance of this ability, the process by which it occurs is not fully understood. Identifying the brain areas responsible may provide insight on the malfunctions occurring in these conditions. To test the involvement of a brain structure known as the locus coeruleus, mice were injected with the toxin DSP4 to destroy brain cells within this area and exposed to CO<sub>2</sub> during sleep. The time it took to wake up to the CO<sub>2</sub> was recorded. DSP4-injected mice were found to take longer to wake up to CO<sub>2</sub>, supporting the involvement of the locus coeruleus in this process. This finding increases our knowledge of how we are able to detect and wake up from increased CO<sub>2</sub> levels during sleep 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 archaeologists 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 Ercildoune 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)

#### *Scintillator X*

Over the past two years I have had the pleasure to work on the research and development of a radiation resistant scintillator, Scintillator X. Although this scintillator is currently being developed for use in high energy particle physics, it may find use in many other fields, such as medical physics in the near future.

So what is a scintillator? Wikipedia defines a scintillator as "a material that exhibits scintillation, the property of luminescence, when excited by ionizing radiation." In less scientific terms, a scintillator is a material that glows in the presence of energy. Scintillator X hopes to do this with the added bonus of being radiation resistant.

### **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)

#### *How Old is the Osborne Intrusion? Using the pXRF to Find Datable Minerals in the Osborne Core*

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 450° 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*

There are a lot of differences between Chinese and American financial systems. Stock markets are a principal component of financial markets, by exploring which we could have a broader picture of the financial system. As we know, the stock price is driven by its intrinsic value. Sometimes, the market prices can bring about misleading information. With the vigorous development of Chinese enterprises, many of them also choose to issue their IPO in America. Due to the asymmetric information, some evaluations of those stocks might be biased. We did some analysis about those stock evaluations and figured out what are some factors leading to misestimation.

### **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)

### *Identification and quantification of winter time pollution sources 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<sub>2.5</sub> and PM<sub>10</sub> have diameters less than 2.5 and 10 micrometers. The World Health Organization (WHO) ranked Nepal as having the 7th highest PM<sub>2.5</sub> 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<sub>2.5</sub> and PM<sub>10</sub> mass and 2) identify and quantify sources of air pollution by measuring organic markers. Organic markers are chemicals that can referring back to the pollution sources. PM samples were collected from Lumbini, Dhulikhel, Ratnapark and Patan in Nepal during the winter (Dec 20, 2017 to Feb 10, 2018). The concentrations in all four locations were higher than the WHO guidelines of 25 µg/m<sup>3</sup> for PM<sub>2.5</sub> and 50 µg/m<sup>3</sup> for PM<sub>10</sub>. To identify sources of PM, organic species will be extracted using organic solvents and quantified using gas chromatography coupled with mass spectrometry. 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)

#### *Molecular Mechanisms of Gene Regulation*

DNA is the material that encodes all of the information for our development and maintenance and allows us to pass traits onto our children. In our cells, DNA is compacted with proteins called histones to form chromatin. This allows us to pack nearly 2m of DNA into the nucleus that is .000006m in diameter. Access to the DNA can be regulated by protein complexes called chromatin remodelers that move the histones to expose DNA, which turns genes "on" or "off" in any cell at any time. This regulation extremely important and is commonly compromised in disease.

Chromatin remodelers are protein machines made up of many different subunits. For proper gene control, these machines must bind to the DNA and the histones at the right time and in the right place, and then move the histones accordingly. Determining how these subunits bind is important to understand gene regulation and what is going wrong during disease. We are interested in one specific subunit called Brahma (BRM). BRM is mutated in many cancers and it is thought to be contributing to tumor development. We are trying to figure out exactly how this subunit works. Specifically, we want to determine how BRM binds to DNA. The techniques we use allow us to monitor the binding of BRM to DNA directly on the atomic level, to understand how it navigates the genome, and how its mutation may alter its function.

### **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 on the upcoming Europa Clipper spacecraft. This mission is scheduled for launch between 2022 and 2025, and will study the Jovian moon of Europa. The University of

Iowa is working with the NASA Jet Propulsion Laboratory to fabricate part of the electronics for the mission. During the summer, I interned at the Jet Propulsion Laboratory in Pasadena, California developing programs and graphical user interfaces (GUIs) to simplify the testing process for the instrument. Once the instrument is built at the University of Iowa, it will be tested at JPL using programs written by my mentor and myself, and then integrated into the spacecraft in preparation for the long journey to Jupiter.

### **67 - Jared McGinnis**

Major: Chemical Engineering

Mentor: Julie Jessop (Chemical and Biochemical Engineering)

#### *Eliminating Oxygen Inhibition during Photopolymerization Reactions*

In industry, a common method used in the production of products such as inks, thin films, and adhesives is photopolymerization. In this process, a mixture of monomer and initiator molecules are exposed to UV light. The initiator molecules absorb energy from this light, resulting in a chemical bonds breaking and radicals forming. These radicals go on to react with monomer molecules, creating polymer chains. The presences of oxygen in air is observed to hinder this process. The radicals can react with oxygen, creating an unreactive molecule that cannot continue to grow the polymer chain. This leads to a tacky layer on the surface of the polymer products. This problem is known as oxygen inhibition. Current methods used to solve this problem are costly to implement. This project seeks to eliminate oxygen inhibition by introducing a second monomer into the formulations that polymerizes using a cationic based reaction instead of a radical based one. Cations are not sensitive to the oxygen in the air and can achieve tack free surfaces even in normal conditions.

### **69 - Emily McLain**

Majors: Communication Studies; Criminology, Law, and Justice

Mentor: Wayne Jacobson (Office of Assessment)

#### *Taking Temperature: Looking at Student Experiences*

This study seeks to further develop previous research looking at what perceived meaningful experiences students at the University of Iowa experience. For the context of this study, we asked undergraduate respondents about their most meaningful, or significant, experience. Their responses created the guidelines for our response categories and concepts. The data that is presented here seeks to understand student

experiences. In doing so, this research can help the University of Iowa better accommodate, construct, and support its students.

## **71 - Camille Mumm**

Majors: Biology, Informatics

Mentor: Robert Cornell (Anatomy and Cell Biology)

### *Investigating the regulation of human and zebrafish periderm enhancers*

Cleft lip with or without cleft palate, also called orofacial clefting, (OFC) is a common birth defect affecting nearly 4,500 babies born in the United States each year. To date, we only know the genes causing approximately 50% of (OFC.) Interferon Regulatory Factor 6 (IRF6), is a well-studied gene that is expressed highly in the embryonic skin (periderm) and known to cause OFC. Mutations in a non-coding region near IRF6 can also cause OFC. Therefore, we need to have a better understanding how non-coding DNA contribute to oral periderm development and consequently OFC. We have developed bioinformatic methods to identify such regions in the zebrafish genome. Testing these regions using a florescent marker in the zebrafish, we were able to determine if they function in the periderm. We identified a region near the periderm gene periplakin that has activity in the periderm. To further investigate this region we are deleting regions we hypothesize to be important for the function of this enhancer and looking at the expression change in the same florescent assay. Using this method we have found that both zebrafish element and a region near human periplakin depend on a periderm transcription factor KLF4 (Kruppel Like Factor 4) binding sites. An improved knowledge on the function of these enhancer regions, even in zebrafish, can assist us in finding genetic and non-coding DNA contributors to CL/P.

## **73 - Taryn O'Brien**

Major: Biology

### *Efficacy of antibody injections as a treatment for premature blindness*

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<sup>-/-</sup>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% O<sub>2</sub> 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 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*

The immune system recognizes and destroys invading pathogens, such as bacteria and viruses. Autoimmunity occurs when the immune system mistakenly recognizes and attacks healthy cells or tissues in the body. Bullous pemphigoid (BP) is an autoimmune disease that disrupts attachment of the outer skin layers and results in severe blistering. It is not understood if or how the skin-resident immune cells play a role in BP. The goal of this study was determine if dendritic cells, an immune cell subset known to regulate autoimmunity, are altered in BP. To study this, we obtained skin samples from BP patients or healthy controls and used special staining techniques to count the relative number of dendritic cells and assess their function. Our study identified numerical changes in these cell subsets. The particular function we measured appeared unaltered in BP, but many other functions were not measured in this test. Future studies will compare multiple functions of live cell subsets isolated from fresh biopsies. These studies will help us to understand the role of different skin immune cell subsets in development of skin autoimmune responses so that better therapies can be developed.

### **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*

Mitochondria are organelles that produce energy within cells. Optic atrophy 1 (OPA1) is an important protein found in mitochondria, which helps these organelles function properly. Brown adipose tissue (BAT) gets activated during cold to increase heat production, a process that requires adequate mitochondria function. However, the role of OPA1 in this process is unknown. Therefore, we made mice that were deficient for OPA1, specifically in BAT and tested how they responded to short-term cold exposure. Female mice were placed in an environmental chamber at 4°C for four hours. Their core body temperature was measured hourly. These mice were found to be more tolerant of the cold temperatures, as their temperature drop over time was reduced relative to control mice. Mitochondria lacking the OPA1 protein had reduced function and looked structurally abnormal. Surprisingly, OPA1 deficient mice were more efficient in utilizing nutrients as fuel and their white fat cells, which usually store energy in the form of fat, had an increased capacity to burn fat and glucose. Our data suggest that removing the OPA1 protein from BAT leads to compensatory mechanisms, resulting in increased metabolism and resistance to cold.

### **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 uranium species in water 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. Initial efforts use polyacrylonitrile (PAN) electrospun nanofibers, which are combined with various forms of phosphonic acid that make the nanofibers selective for uptake of U. After soaking in solution of known concentration, the nanofibers are analyzed using Liquid Scintillation Counter (LSC) and Inductively Coupled Plasma-Mass Spectroscopy (ICP-

MS). The length of the carbon chain in the phosphonic acid was changed, and total uptake of uranium was observed with the longer chains, which was confirmed by both LSC and ICP-MS results. In addition, stability of the phosphonic acids was assessed, and washing experiments indicated that the various incorporations of phosphonate groups into the mat depends 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*

In southwest Florida, seagrass beds are important ecologically and economically due to their ability to slow fast currents and the wide variety of organisms they support. The combination of these items leads to the buildup of organic matter and high rates of decomposition. This decomposition produces sulfides which, at high levels, can be harmful to the seagrass plants. This study looked at one of the natural removal mechanisms for sulfide: Lucinid clams. These clams have bacteria living in their gills that remove sulfide and use it to make sugars as fuel for themselves and their hosts. Seagrasses release oxygen into the sediment providing benefits for the clams. This symbiotic relationship was studied in the waters surrounding Sanibel and Captiva Islands. Bivalves (such as clams and mussels) were collected and identified from 19 sites along with data on seagrass biomass, water chemistry, and sulfide levels. The data showed more seagrass biomass in areas of higher lucinid clam abundances. 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 Structural Refinement*

Where experimental data and resources are lacking, biochemists can supplement their studies of protein structure and function with the analysis of computational protein models, called Protein Data Bank (PDB) files. When accurate, PDB files provide high-quality models that can be

simulated and studied for genetic research. To create accurate protein structures, we use the Force Field X (FFX) molecular biophysics software. FFX optimization algorithms calculate the amino acid side-chain conformations that lead to an energetically favorable protein model. 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 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 has a major retirement problem which is only worsening as the retirement landscape continues to shift. With many employers focused on cost cutting, common retirement benefits have changed from defined benefit plans (guaranteed monthly income) to defined contribution accounts (voluntary investments). This has enlarged America's retirement problem as overall participation throughout U.S. employees has decreased to under 50%, with much larger exposure to market performance. This is a major issue as social security, which accounts for the largest percentage of retiree's monthly income retiree's, is also dwindling and forecasted to invert by 2034.

With this being said, the question that arises asks, "Why aren't American's more focused on saving for retirement?" The first major hurdle that

discourage and defer Americans 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 according to data gathered from the U.S. Census Bureau and further analyzed on a state-based dollar value.

## **91 - Gustave Stewart**

Majors: Political Science, Economics

Mentor: Elise Pizzi (Political Science)

### *Inequality, Urban Goods, and Participatory Budgeting within Brazil*

Brazil experiences inequality in urban areas, which is reflected in an individual's wage and neighborhood characteristics. The analysis I performed looks at roads, sidewalks, public lighting, afforestation, open sewage, and wheelchair ramps across wage groups to understand how inequality manifests itself in Brazil's urban environment. Urbanization has led to an increase in demand and pressure for local governments to provide services and infrastructure. The analysis looks at 196 Brazilian municipalities and identifies two different type of infrastructure goods: (1) higher-wage goods and (2) lower-wage goods. Sidewalks and wheelchair ramps were determined as higher-wage goods because higher wage earners were more likely to have the good with the presence of participatory budgeting (PB). Comparatively, public lighting and open sewage were considered lower-wage goods because lower wage earners were more likely to have those goods when PB was present. PB is a mechanism that allows more individuals to partake in the creation of a city's budget and was started in 1989 in Porto Alegre, Brazil. In turn, this analysis finds that participatory mechanisms can influence how urban infrastructure is distributed across varying wage groups.

## **93 - Hanxi Tang**

Major: Biology

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

### *Gut microbiota composition is significantly affected by a seizure-causing mutation in fruit flies*

The gut microbiota is a diverse community of microorganisms in the digestive tracts of humans and other animals. It plays critical roles in the metabolism as well as immunity of the host animals and is essential for

their health and well-being. Interestingly, recent studies also 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. To study how the brain interacts with gut microbes, we use a fruit fly model, paraShu, that exhibits neurological defects. We examined the microbiota composition in the gut of paraShu flies 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 freyschussii*. We are currently investigating the underlying mechanisms of this intriguing finding that abnormal neurological activity lead to altered gut environments and microbiota composition.

## **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: Root canal therapies require chemical and mechanical debridement to reduce infection and inflammation, but there is often reinfection after treatment. Here, we assessed the ability of bleach (NaClO) in combination with 255 nm light emitting diode (LED) to kill a bacteria, *Enterococcus faecalis*, which is associated with persistent infections. Methods: An assay was developed where *E. faecalis* was put into holes in a blood agar plate. Each hole was administered a different treatment; water, 255 nm LED and water, 1% NaClO, 255 nm LED then 1% NaClO, and 1% NaClO then 255 nm LED. The holes were rinsed and put in spots on blood agar plates. At 24 hours, bacterial colonies in each spot were counted. Results: *E. faecalis* remained viable in water and had an average of 38.1 colonies. The treatments 255 nm LED with water and 1% NaClO produced significantly less colonies with averages of 9.8 and 10.1. The treatments 255 nm LED with 1% NaClO produced even fewer colonies with averages of 2.1 and 1.2. Conclusion: The results in this study suggest that using 255 nm LED and NaClO as an adjunct to chemical and mechanical debridement improves the killing of bacteria in root canal therapies.

## 97 - Jamie Tigges

Major: Environmental Science

Mentor: Heather Sander (Geographic and Sustainability Sciences)

### *Mesopredator influence on Passeriformes*

In a natural ecosystem interactions among animals are frequent, and often predatory in nature, with the prey species most likely being eaten by the predator. These prey species often times must worry about multiple different predators. Cities, suburbs, or maintained natural areas, and farmland offer a different perspective on this prey/predator dynamic, as the habitats have become lower in quality, smaller, and force species to interact with humans on a daily basis. Given these urban environments, what would the relationship between songbirds, corvids, and flycatchers look like when compared to medium sized predators such as cats, coyotes, and raccoons to name a few? Using camera traps and birding field surveys we compiled a data set involving occurrence of mammal species, and an abundance of each bird species documented. The initial indication is a strong relationship in species which prefer and share similar habitats. We found multiple negative relationships which may indicate predation or a preference to not live in the same habitat, or possibly behavior changes in the nesting birds. These results could act as a stepping stone to future research into urban environment food webs and species interaction, which could include other predators such as birds of prey, rodents, or snakes.

## 99 - Nitya Virippil

Major: Human Physiology

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

### *The benefits of sublethal radiation in parasitically infected mice*

Radiation exposure is of an increasing environmental risk to humans. Exposure to high doses of radiation that exceed 4 Gray (Gy) are often fatal without medical intervention. Low dose radiation exposure is not fatal. However, the long-term effects of these exposures significantly impact quality of life. We tested the hypothesis to see if infection with the helminth *Heligmosomoides polygyrus* (*H. polygyrus*), an intestinal round worm, alleviates radiation-induced toxicity by promoting cell survival. Following 60 days of *H. polygyrus* infection, mice showed heightened immune responses through peripheral blood cell analysis. After infection animals were subjected to 4 Gy whole body radiation. Preliminary data showed an increased survival of lymphocytes from *H.*

polygyrus-infected mice during sublethal irradiation. *H. polygyrus*-infected mice also had less reduced weight changes following radiation exposure. The protection provided by *H. polygyrus* infection during irradiation may be a natural therapeutic strategy for high-risk radiation groups that include nuclear plant workers, astronauts 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)

#### *Identifying Gene Targets to Combat Resistance in Melanoma Treatment*

Melanoma is an aggressive form of skin cancer in humans. In melanoma, there is a common DNA mutation that leads to uncontrolled cell growth. Drug treatments have been established to target this mutation, thereby reducing the growth effects of the gene signaling pathway it uses. While these drug treatments have initial success, the majority of patients later develop resistance to the treatment and the cancer once again progresses. It is important to understand the mechanisms of resistance in melanoma, in order to discover new treatments that can limit resistance and increase patient survival. In an effort to discover why patients become resistant to melanoma therapy, we performed a genetic screen using human cells adapted to grow in culture. By doing this, we identified four possible candidate genes that could be involved in resistance pathways. We validated each candidate gene and confirmed that cells that overexpress each gene have increased cell growth. By identifying genes that may be involved in resistance pathways, additional drugs to target these genes can be combined with traditional therapy to better combat resistance.

### **107 - Rion Wendland**

Major: Biomedical Engineering

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

#### *Tagging of Batten Disease Protein for Observation*

Batten disease is a neurodegenerative disorder that causes blindness, epilepsy, and death due to genetic mutations that cause changes in a protein called CLN3. Although previous studies have uncovered some information about the location of CLN3 within a cell, the reason that mutations lead to neurodegeneration remains unclear. In this study, we designed and tested homing mechanisms (a.k.a. guides) that will be used to tag CLN3 with markers that facilitate visualization and isolation from other proteins. Of the five guides that we tested, we successfully identified one that can be used to add a tag specifically to CLN3, which

is a critical first step in the tagging process. Now we are poised to use this approach to better understand the role of CLN3 within neurons, both for healthy individuals and those suffering from Batten Disease.

### **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 in Mice*

In this experiment, we investigated the role of a particular protein. The protein of interest plays a role in mitochondria shape, as well as function. In mice, as well as our own bodies, there is brown fat and white fat. White fat is generally used for storage of excessive calories, while brown fat provides heat. We deleted our protein exclusively in brown fat in mice. We analyzed the mitochondrial capacities of these knockout mice, as well as their response to a high fat diet. The mitochondria taken from brown fat were noticeably disrupted, and had impaired function. A high fat diet was fed to knockout mice and normal mice. The normal mice showed diabetic symptoms and became obese, while the knockout mice did not gain weight and showed no diabetic symptoms.

### **111 - Cheng Zha**

Major: Biomedical Engineering

Mentor: Sarah Vigmostad (Biomedical Engineering)

#### *Real-time Air Pollution Alerting System*

I originally come from Shanghai, China. As an economic and global international center for a country in developing country, citizens in Shanghai has been troubling by the serious air pollution since many decades ago. Based on my current researches, I am considering that a system with a wearable air pollution detector device and real-time data sharing could be very helpful for parents to check the air environment for their children in any time they want. Based on the same idea, this system could also be essential for people in a high-risk air pollution working environment to make sure it is safe for them to keep working in that environment.

My original research & design idea is to combine the air pollution detector with one of those devices that people carry with them in most time. Because there are many different kinds of air pollution detectors already exist in the market right now. Therefore, my researches and

designs are more focus on how to simulate the way for people to wear this device in order to make sure this device could actually be used by people in most time.

### **113 - Lexi Zocher**

Major: Human Physiology

Mentor: Gordon Buchanan (Neurology)

*An examination of brain regions activated in CO<sub>2</sub>-induced arousal from sleep*

Waking up due to an increased amount of carbon dioxide (CO<sub>2</sub>) in the bloodstream is a positive protective mechanism. Neurons that make the brain signaling molecule serotonin are important in this arousal process. The goal of this experiment is to determine which neurons serotonin neurons activate in mediating CO<sub>2</sub>-induced arousal. Two groups of mice, one expressing serotonin neurons and one not expressing serotonin neurons, were used in this experiment. Mice were challenged with CO<sub>2</sub> or room air to breathe, or were given perfusions of normal or CO<sub>2</sub>-enriched artificial cerebrospinal fluid into the brain (directed at a brainstem nucleus containing serotonin neurons). Directly after the trials, animals were euthanized and brains collected for processing to identify activated neurons. The most active brain regions are likely to be most important in CO<sub>2</sub>-induced arousal.

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

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### **2 - Brittany Allendorf**

Major: Human Physiology

Mentor: Kelly Messingham (Dermatology)

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

Typically, the cells and antibodies of the immune system identify invading pathogens, such as bacteria and viruses, so that they can be destroyed. Autoimmunity occurs when the immune system mistakenly recognizes healthy cells in the body. Bullous pemphigoid (BP) is a disease where antibodies bind to skin cells, which disrupts attachment of

the outer skin layers and results in severe blistering. The goal of this study was to determine if the skin cells might contribute to BP via production of chemical signals that could alter the function of immune cells in the skin. To study this, we obtained skin samples from BP patients or healthy controls and used special staining techniques that can be used to determine which cell types are making these factors and also the relative amount that is present in skin from BP patients or controls. So far, we have shown that these factors are elevated in BP skin and are determining which cell type(s) are responsible. Ultimately, these studies will provide information essential to understanding the role of the skin cells in the induction, maintenance and development of skin autoimmune responses so that better therapies can be developed.

#### **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 study sample included 111 observations of 25 residents, 29 staff members, and 9 different nursing home locations. It was found that 78% of feeding attempts were successful, and 22% of attempts were unsuccessful. It was found that the feeding assistants spoke most frequently with 68% of the total verbal communication codes, and primarily to residents, with 72% of the feeding assistant's codes directed towards them. 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. Bivariate analyses were used to describe the relationship between verbal communication and intake. There was a significant and positive relationship between total intake and total communication, as well as successful intake and positive communication. This provides evidence that there is an important relationship between mealtime verbal communication and nutritional 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. Web-based interventions have examined the management of multiple symptoms for advanced cancer, but have rarely focused on the impact of symptom management on mood-state indicators such as depression and anxiety. Advanced cancer patients in rural areas have less access to symptom management than their urban/suburban peers, which led to the development of Oncology Associated Symptoms and Individualized Strategies (OASIS). OASIS, a web-based symptom management intervention, supports the development of self-management strategies for patients. The purpose of this study is to examine relationships between the demographic characteristics of those participating in OASIS and mood scores (anxiety and depression). Four surveys, one baseline and three follow-up, were collected from 17 patients. The surveys consisted of a demographic questionnaire and a numeric symptom rating scale (1-10) for depression and anxiety severity and distress. Analysis of the surveys was performed and demographic characteristics of the sample are described. Correlations between demographic characteristics and mood scores and an analysis of score changes in those who completed all four time points (6 participants) 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 O<sub>2</sub> and produces superoxide (O<sub>2</sub><sup>-</sup>), which then dismutates to hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>). 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, like phosphorus and nitrogen, from terrestrial sources, such as farmland, industrial sites, and residential areas, have led to rapid growth in dead zones (Areas in which no life can exist due to lack of oxygen, nutrients, and other resources necessary for life) along coastal regions. Macroalgae, a seaweed, is well-known for its ecosystem services such as nutrient sequestration, and can be used to restore the eutrophic waterways that are creating dead zones, while simultaneously creating economic opportunities through aquaculture practices (Cultivation of aquatic plants or animals for food sources or commercial products).

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. 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.

## **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 biological processes driving addiction and drug seeking is needed. Previous work has implicated acid-sensing ion channel-1A (ASIC1A) in responses to drugs of abuse, suggesting a possible target for new therapies. ASIC1A is located throughout the brain and is activated by extracellular acidosis. Our previous studies with

ASIC1A showed changes in cocaine-evoked behavior. Current techniques can manipulate the amount of ASIC1A expressed, allowing for elimination or overexpression of the protein. Eliminating ASIC1A in mice increased their preference for locations associated with cocaine, while overexpressing ASIC1A in rats reduced the amount of cocaine they self-administered. We hypothesized that *Asic1a*<sup>-/-</sup> mice would have increased cocaine self-administration compared to wild types. *Asic1a*<sup>+/+</sup> and *Asic1a*<sup>-/-</sup> 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. Interestingly, consistent with our hypothesis, preliminary findings suggested that *Asic1a*<sup>-/-</sup> 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*

Obesity is a growing epidemic in the United States. In a mere 40-year span (1970- 2014), the prevalence of obesity has tripled. Consequently, weight loss strategies have been devised to curtail this rising trend – one of which being a ketogenic diet. A ketogenic diet is a high fat, low carbohydrate diet that is used to promote a state of fat burning. In this study, male and female mice were placed on ketogenic diets to evaluate its efficacy in reducing body weight and promoting other metabolic utilities. It was found that only males manifested lower body weights on the ketogenic diet. Furthermore, females on ketogenic diet displayed an impairment in dissipating glucose (sugar) in the bloodstream upon glycemic challenge.

### **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*

We can identify the source location of raw materials used for stone tool



manufacture by comparing them to type collections available from the Office of the State Archaeologist. We can then determine how far people are moving across the landscape to acquire raw materials and what proportion of their tools are being made locally.

## **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*

Mitochondria, the power houses of cells, are fragmented and dysfunctional in skeletal muscle of diabetic patients. Mitochondrial fragmentation suggests that the activity of the protein responsible for mitochondrial division (that is, DRP1) is elevated in diabetics and, thus, might be a therapeutic target. We developed a mouse model of depletion of DRP1 in skeletal muscle [that is, knock out (KO) mouse]. KO mice were resistant to weight gain, without changes in glucose intolerance, energy expenditure and permeabilized skeletal fiber respiration. The lack of improved glucose tolerance despite weight gain resistance is puzzling but may reflect severe insulin resistance at skeletal muscles since birth. We speculate that weight gain resistance in the setting of unaltered energy expenditure and skeletal fiber respiration in KO mice might be associated with secretion of muscle-derived adaptive hormones targeting distant organs like the fat 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 decision-making can be improved via incentivizing. The purpose of this experiment was to study how well individuals could solve a series of logic problems when given different amounts of information and payment types. 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 affected or unaffected by the answers they gave. 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 who were paid based on how they answered each task were more likely to select the exact correct answer than those whose payments were unaffected by 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 infralimbic cortex (IL) in a rodent is necessary to inhibit cocaine-seeking behavior. Rats learned to self-administer cocaine by pressing an active lever which resulted in an infusion of cocaine. During cocaine self-administration, the IL is important for promoting cocaine-seeking behavior. In the extinction period, when nothing happens following a lever press, the rats learned to withhold cocaine-seeking behavior and this brain region decreased cocaine seeking. We know the infralimbic cortex is important to control cocaine-seeking behavior, but literature fails to explain how neural activity in the IL changes as rats learn to inhibit their cocaine-seeking behavior. The technique of *in vivo* electrophysiology was used to examine single cell activity in the IL when rats underwent cocaine self-administration, extinction, and reinstatement. This technique entails lowering a wire into the brain and

listen to the firing of a neuron. The data revealed there were not significant changes in the percentage of neurons that fire during the extinction training. Instead, during the extinction training where the rats learned to withhold their lever pressing behavior there was an increase in neuronal bursting and baseline firing rates. Our data helps us better understand the changes that occur in the brain after chronic cocaine use.

### **32 - Rebecca Hauser**

Major: Speech and Hearing Science

Mentor: Inyong Choi (Communication Sciences and Disorders)

#### *Auditory Evoked Potentials in Hybrid Cochlear Implant Listeners*

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

### **34 - Nicole Hehr**

Major: Ancient Civilizations

Mentor: Alexander Bassuk (Pediatrics, Neurology)

#### *Activation of Retinal Glial Cells after Traumatic Brain Injury*

Traumatic brain injury (TBI) causes about 30% of all injury-related deaths in the United States and those that survive can face permanent disability

including visual deficits. After the initial injury, ongoing inflammation causes tissue damage. The retina is the light sensitive portion of the eye where visual transduction occurs and is an extension of the central nervous system. We hypothesized that the eye would also experience inflammation after TBI. We used a blast traumatic brain injury (bTBI) mouse model, in which the mouse is exposed to a pressure wave, to examine the effects of TBI in the retina. Four hours after blast injury we observed an increase in inflammatory markers in the retina. We also saw cellular activation of microglia and astrocytes, which are supportive glial cells that can respond to injury, one-week post blast. This knowledge could be used in the future to pharmacologically target these inflammatory pathways that cause tissue damage after a traumatic brain injury.

### **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 function and shape. The role of OPA1 in fat tissue is incompletely understood. We generated mice lacking OPA1 in fat tissue (OPA1 Ad-KO) and observed that these mice were resistant to becoming obese and diabetic when fed a high-fat diet (HFD). OPA1 Ad-KO also had increased levels of the anti-obesity and anti-diabetes hormone fibroblast growth factor-21 (FGF21) in the fat tissue and in the circulation. We, therefore, sought to test whether fat-derived FGF21 was required for the resistance to obesity observed in OPA1 Ad-KO mice. For that, we generated mice lacking both OPA1 and FGF21 in fat tissue (DKO). DKO mice were placed either on 60% high-fat diet (HFD) or 10% fat control diet for 12 weeks. DKO mice had reduced body weight and total fat mass after 12 weeks of high-fat feeding. Their ability to expand energy was increased, while food intake and activity were unchanged. However, their ability to maintain normal blood glucose levels was compromised. In conclusion, fat tissue-derived FGF21 is not required for the resistance to obesity observed in OPA1 Ad-KO mice, but may contribute to improved glucose clearance.

### **38 - Hannah Hildahl**

Major: Human Physiology

Mentor: Kelly Messingham (Dermatology)

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

Typically, the cells and antibodies of the immune system identify invading pathogens, such as bacteria and viruses, so that they can be destroyed. Autoimmunity occurs when the immune system mistakenly recognizes healthy cells in the body. Bullous pemphigoid (BP) is a disease where antibodies bind to skin cells, which disrupts attachment of the outer skin layers and results in severe blistering. The goal of this study was to determine if autoantibodies are being produced locally in the skin of BP patients. To study this, we obtained skin samples from BP patients or healthy controls and used special staining techniques to identify, and count the relative number of, antibody-producing cells. So far, we have shown that although cells capable of producing antibodies are found in the skin, they are not actively producing IgE antibodies. Ongoing studies will use a similar approach to determine if another antibody type, known as IgG, are produced in BP lesions. Ultimately, these studies will provide information essential to understanding the role of skin immune cells in the induction, maintenance and development of skin autoimmune responses so that better therapies can be developed.

### **40 - Jianwei Hu**

Major: Biomedical Engineering

Mentor: Ernesto Fuentes (Biochemistry)

*Finding of the 3-Hydroxypropionic acid(3-HP) binding site on MmsR Lys-R family transcriptional factor*

3-Hydroxypropionic acid(3-HP) is one of the important chemicals for industry use. During the process of producing 3-HP we can't directly see or measuring the concentration of 3-HP. A biological sensor will help greatly to the process. Previous studies showed that a specific protein MmsR which belongs to LysR transcriptional factor family will react with 3-HP molecules and promote the gene expression. We can use the fluorescence promoted by MmsR to infer the concentration of 3-HP. In the research, we are trying to computer modeling the structure of the protein and predicting the binding site of 3-HP. We cloned the gene of that protein into the E. coli cell, harvested the protein from the cell, and

purified the protein by a series of techniques. We did several assays and measured the interaction difference between the purified protein and several small molecules. Based on the interaction, we found the real binding site.

## **42 - Qitong Jin**

Major: Electrical Engineering

Mentor: David Andersen (Electrical and Computer Engineering)

### *Terahertz Continuum Generation in the LCS Lattice*

When placed in a strong light field, electrons in a lattice tend to jump between energy bands with a certain frequency, which is known as Rabi frequency. Rabi frequency in a lattice can be defined by transforming time-dependent Dirac equation into the length gauge. The oscillation of electrons is also called Rabi oscillation, which contributes to the generation of current density. By conducting Fourier analysis of the current density, its harmonic spectrum (frequency spectrum) can be obtained. Line-centered-square (LCS) lattice is an artificial, 2-dimensional lattice that only exists in an ultra-cold environment and possesses a unique energy band-structure: it has a conduction band, a valence band and a flat energy band in between. Here we show that, when LCS lattice is subjected to a strong light field, it can exhibit Rabi oscillations, generate current density and show a continuous frequency spectrum in a terahertz regime.

## **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*

Although the cerebellum is a region of the brain traditionally known for its role in motor control, a growing body of research shows that the cerebellum is involved in cognition. Recently, cerebellar stimulation has been explored as a therapeutic approach for neuropsychiatric disorders accompanied by cognitive abnormalities. The effectiveness of these interventions might be improved by stimulating specific regions of the cerebellum. In particular, one region on the surface (cortex) of the cerebellum called Crus I has been shown to be specifically involved in cognitive processes. To test whether manipulating Crus I could improve

cognitive performance, we trained rats in a timing task and either activated or inactivated Crus I with drug infusions. Timing was used because the ability to estimate the passage of time is a cognitive process that is crucial to survival and conserved from rodents all the way to humans. We find that inhibiting Crus I disrupts timing behavior, while activating Crus I has no effect. However, when the frontal cortex is also inhibited, activating Crus I can rescue a timing deficit caused by frontal dysfunction. This suggests a potential therapeutic role for Crus I in disorders of frontal lobe 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*

Mitochondria and Endoplasmic Reticulum (ER) Contact sites (MERCs) are regions within a cell where mitochondria and ER come into proximity. MERCs are enriched with specific proteins and lipids that aid in specialized structural rearrangements of this region for the management of numerous cellular processes, such as the regulation of mitochondrial morphology and are critical for the prevention of disease states such as diabetes. Additionally, it also has been shown that MAM integrity is needed in the cell to maintain insulin sensitivity. Therefore, we hypothesize that insulin stimulation can increase MAM interactions. To

test this hypothesis, we surveyed for several MERCs proteins after 2 hours on insulin stimulation. We found that MAM proteins AKT, MTOR, and MFN-2 were altered after insulin stimulation in primary myotubes. Next, we utilized TEM analysis to determine if insulin stimulation increased the number of MERCs. Analysis of TEM demonstrated mitochondria were more fused, had more cristae, and had an increase number of MERCs after insulin stimulation. Collectively, these data suggest that insulin stimulation may activate an IR-AKT-MTOR dependent mechanism that regulates the number of MERCs in a cell.

## **52 - Ben Kirk**

Major: Biomedical Sciences

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

*OPA-1 deficiency promotes muscle atrophy through upregulating 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*

All cells in the human body possess identical genomes, yet cells are capable of becoming highly specialized. The difference between a neuron and muscle cell is not DNA sequence, but what genes are and are not being expressed. This differential expression is influenced by DNA packaging in the cell nucleus, with compacted DNA being repressed and open DNA being expressed. One protein capable of binding DNA and influencing gene expression is Barrier-to-Autointegration Factor (BAF). In particular, BAF has been shown to play a role in maintaining stem cell populations. A mutated BAF protein found in humans has been shown to cause NÃ©stor-Guillermo Progeria Syndrome (NGPS), a progressive aging disorder. We study NGPS using *Drosophila melanogaster* as a model organism because the fly BAF protein is 65% identical to human BAF. *Drosophila* also allows us to study the NGPS mutant BAF protein both in a test tube with biochemical assays, and in a living organism. Here we show that the biochemical properties of fly BAF are significantly different from human BAF and that the NGPS mutation has a very localized effect on protein structure. Further experiments with the NGPS mutant BAF will elucidate the biochemical differences between NGPS and normal BAF.

### **56 - Jared Kowalski**

Major: Finance

Mentor: Jeffrey Hart (Finance)

## *Is the desire of taking a company public dying?*

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)

## *Characterizing a new factor of chemotherapeutic resistance in childhood leukemia*

### **60 - Adrian Les**

Major: Chemistry

Mentor: Johna Leddy (Chemistry)

### *Using Electrochemistry to Measure Polymer Compressibility*

Compressible polymers are important in pharmaceuticals, especially for their use in delayed or slow-release capsules. The timing and effectiveness of these drugs are dictated by the properties of the polymer used, so determining these properties is key to optimizing drug delivery. The current methods used to characterize these polymers require dangerously high pressures, and these methods are inaccurate at moderately low pressures. Using electrochemical techniques to characterize polymers would lead to a better understanding of how they behave under the pressures at which they are typically used. The goal of this work is to develop a method to characterize polymers electrochemically, which would allow the characterization of a multitude of polymers in a fast and safe manner.

### **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 is a highly diverse, Neotropical genus of fruit flies that feed on cucurbit host plants. Like most plant-feeding insects, Blepharoneura are highly specialized, with most species using 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 frequently share host plants, and often use the same plant tissues. To investigate what role, if any, host use plays in driving divergence, we 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 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), early delivery of the fetus, and damage to kidneys, liver and small (micro) blood vessels. Impaired microvascular health is present in chronic diseases such as aging, cardiovascular disease and kidney disease, but it is unknown if this impairment occurs in preeclampsia. To measure the health of the microvasculature we will utilize a microscope camera

placed beneath the tongue to take images of the blood vessels. An aim of this study is to identify if the GlycoCheck, a software tool that is able to obtain measurements of the microvascular health from small blood vessels under the tongue, can be used as an early diagnostic tool for the development of preeclampsia. Those images will be analyzed by the GlycoCheck software to quantify measurements of microvascular health in pregnant women who have normal pregnancy or pregnancy complicated by 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*

Categorization is a learning and memory process that groups objects together according to common features. For instance, dogs have a snout and a tail, whereas frogs have webbed toes and green skin. Learning new

categories involve identifying these relevant features, an ability that has been attributed to the Prefrontal Cortex (PFC) in humans. In this experiment, we examined the role of the PFC during category learning in rats. Animals were injected with either a control solution or a drug that lesioned the PFC. Then, the rats were trained to categorize different objects. Initial results have shown that animals without a PFC were impaired on tasks where they had to categorize according to a single stimulus feature but were not impaired on tasks where categorization required all stimulus features. This means that the PFC is important for finding relevant information and ignoring irrelevant information. Additionally, we conducted control experiments to ensure that removing the PFC did not impair learning because of unintended reasons, such as preventing the animal to learn the task's procedures or causing a loss of motivation.

## **72 - Madison Merfeld**

Major: Biology

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

### *Evaluating the Role of ASIC1A in the Sedative Effects of Alcohol*

Alcohol abuse and addiction are widespread problems. Sensitivity to alcohol is a risk factor in the development of alcohol use disorder. A molecule in the brain that may influence alcohol response is acid-sensing ion channel 1A (ASIC1A). We previously found that mice without this molecule have different motor behavior after receiving alcohol. To see how mice with and without ASIC1A react to higher, sedating doses of alcohol, we assessed behavioral changes by testing whether they were able to right themselves following an injection of alcohol, and by rating their behavior on a scale to see how sedated the mice became. We saw that mice without ASIC1A did become intoxicated, but tended to become less sedated. This suggests ASIC1A may be involved in mediating the sedating effects of alcohol, and may alter risk for development of alcohol use disorder. This information could be useful in identifying people at risk for alcohol use disorder and for developing treatments.

## **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 those artifacts' location. It is important to archaeological analysis 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 artifacts left by native peoples. This helps document the space occupied within and in front of the shelter, and will provide an important basis for future analyses. It will also be key to understanding shifts throughout time in the location of critical features; roof collapse may have caused the location of these features to have changed between occupations.

### **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)

### *Meteorites Versus Meteor-Wrongs*

This project compares the compositions of meteorites and meteor-wrongs to better understand and classify samples. The term meteor-wrong is used to describe a rock that has similar visual characteristics of a meteorite but is a rock formed on Earth as opposed to having formed in space and landed on Earth. The comparisons are made through data collected on both meteorites and meteor-wrongs about the elements they are made of. A pXRF uses X-rays to analyze the elemental composition of a sample and records them by weighted percentages. Each sample is analyzed multiple times to increase accuracy as well as in two different modes of analyses, one being focused on metal elements and the other on nonmetal elements. The collected data reveal patterns in the amounts of certain elements that can distinguish a meteorite from a meteor-wrong. For example, meteorites often contain above 50% iron and 5-10% nickel and little to no copper, tin, or zinc. Therefore, if an unknown sample was discovered to share these percentages it could be classified as a meteorite. Conversely, if a sample were discovered to include large amounts of copper it would be identified as a meteor-wrong. Compiling this data would allow it to be used as a guide in order to rule out a sample as a meteorite, or confirm it is one, with a quick test using the pXRF which can be easily transported and used 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 using ActiGraph Accelerometers*

Actimetry is the study of objectively measuring physical activity through devices called accelerometers. Prescribed activity is emerging as a new frontier in both preventative and rehabilitative medicine, with objective measures of physical activity (PA) being used for healthcare and recreational purposes. 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. Despite technological advances, a lack of standardization regarding the conversion of raw acceleration outputs to useful measures of step counts, energy expenditure (EE) and time spent in moderate-to-vigorous activity (MVPA) remains problematic. Although actimetry remains an objective measure of PA, outputs may be dependent on algorithms used. Thus, the purpose of this study was to quantify the effects of analysis methods on PA metrics. Data from 134 participants wearing an ActiGraph GT3X Accelerometer on the wrist for one week was analyzed using five to seven methods for each metric. Large variations in PA estimates between methods were observed for EE ( $\approx 83\%$ ), MVPA ( $\approx 100\%$ ), and steps ( $\approx 40\%$ ). 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*

Breast cancer is the most common cancer and the second-most common cause of cancer death in U.S. women. With 75% being estrogen receptor-positive, endocrine therapies (ET) have been deployed to treat breast cancer patients. Despite diagnostics and treatment advances, breast cancer remains wholly incurable due to its developed resistance against treatments such as tamoxifen. The machinery driving ET resistance

remains largely unknown, and as a result clinical management is limited on effective approaches for combating resistance. To find some idea on the persistence of breast cancer, we performed an unbiased CRISPR-based genome-wide screen and identified a large set of genes. These genes, when silenced or downregulated in activity, could potentially allow tumor formation, metastasis, and drug resistance. Our recent studies have identified two of these candidate genes, NFKB1 and NEGR1, whose downregulation promotes breast cancer cell growth in vitro (cultured cells), suggesting that they may have tumor suppressive properties. Thus, this CRISPR has identified novel tumor suppressors involved in ET resistance in ER+ breast cancer.

### **86 - Mara O'Connor**

Major: Human Physiology

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

*The relationship between Autism-associated genetic mutations with behavioral performance and brain activity*

Introduction: Autism spectrum disorder is a genetic disorder. Specifically, the branched chain ketoacid dehydrogenase kinase (BCKDK) gene can have a mutation that disrupts its functioning. This mutation leads to unlimited metabolism of branched chain amino acids, the building blocks for proteins. Methods: To determine whether this genetic mutation can be correlated with behavior, we tested performance of mice that had the BCKDK gene removed from their cells. We examined brain activity levels by staining brain sections with a dye called C-fos, which only illuminates active nuclei, allowing us to count active cells in the caudate putamen of the brain. Results: Counting the active cells determined that the density of the caudate putamen was larger in female test mice than normal mice. However, this difference was not statistically significant. The behavioral test found that female test mice were better at learning than normal mice. Conclusion: Although there were not statistically significant changes found in active neuron densities, there were significant changes in behavior. Previous studies found that the density of male brains for this particular section was significantly lower in the test mice than in the normal 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 Tumor Formation in a 3D Model Reveals A Central Role for Cell Surface Molecule Integrin $\alpha$ -3 $\beta$ -1*

One of the major goals in cancer research is to find drugs that block the formation of tumors. The Developmental Studies Hybridoma Bank (DSHB), a National Resource housed at Iowa, has the largest noncommercial collection of monoclonal Antibodies (mAb), which represents a major resource for cancer drugs. We have analyzed 266 mAbs for their capacity to block cells from forming model tumors in 3D cultures, and found six with blocking activity. To our surprise five mAbs were against one surface molecule (target). The single identified target will allow us to generate new mAbs with the potential for use in blocking tumor formation in humans.

### **90 - Marissa Roseman**

Major: 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: some invest a lot of resources into a few offspring, some make many offspring but put little investment into each, and some use intermediate strategies. Why does variation in such extremely important traits exist? In this experiment, we explore whether disease might contribute to the variation in life history traits. We used a New Zealand freshwater snail that is found in lakes with high levels of a parasitic worm and lakes with low levels of the parasite. Snails infected with the parasite are unable to produce babies, so we hypothesized that the risk of infection in these lakes may affect the snails' growth rate and the size and age at which they had babies. Female snails whose grandparents came from high-infection lakes and low-infection lakes were isolated in cups and checked frequently for offspring. Their growth rate was recorded, as was their size and age when they first had babies. The results showed that snails that grew at a faster rate also tended to have babies sooner. The time it took them to have babies was not linked to their adult size. Originating from the same lake was a better predictor of life history traits than level of lake infection (high or low). This suggests that adaptations to each lake may be more important to life history variation than disease is. It also poses the question: what hidden costs of rapid growth and early reproduction may contribute to variation in life history traits?

### **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 the development of musculoskeletal injuries in many populations, yet remains relatively difficult to quantify during ongoing activity. Mathematical models have been developed to estimate muscle fatigue, however, model accuracies are dependent on how well their defining parameters are able to fit observed fatigue behavior. It is unknown how many fatigue data points are required to best fit these models. Thus, the purpose of this study was to compare the results of fitting a fatigue model using four versions of published fatigue data. Twenty datasets were found that reported at least 8 maximum efforts occasionally throughout a fatigue task involving rest intervals. The original datasets and three reduced versions, edited by reducing the observed fatigue data points by half, were used to fit the fatigue model. The resulting parameter values from the reduced fatigue datasets were compared to the values obtained using all available data. We found that with less data the model over predicts the fatigue and recovery rates. However, estimates were least altered when fatigue data (MVCs) were included 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*

STEM Innovator measures students' innovation, invention & entrepreneurial skills and mindsets through a portfolio assessment composed of six items. 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 items are collected a minimum of three times across the course of the innovation process. The Innovator Profile measures 34 different skills and mindsets and the Team Value Rubric assesses group and individual collaboration and team problem solving skills. Pitching project advancements to peer, instructor and community members provides data to the teams on project direction and whether they should verify or pivot their direction. The STEM Innovator Canvas® provides a snapshot of current progress through identification of data to support claims, partnerships and sustainability potential. Students also submit a proficiency exam covering topics in engineering design,

scientific practices and entrepreneurship. Submission of all portfolio items qualifies students to earn college credit. 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. Findings indicate students increase their innovation skills and mindsets across the course of the project.

### **96 - Nicholas Shaw**

Majors: Biochemistry, Psychology

Mentor: Lori Wallrath (Biochemistry)

#### *LINCing the nucleus and the cytoplasm in muscle*

Cells are divided into the nucleus (which houses the genomic DNA) and the cytoplasm. These two cellular compartments are separated by a double membrane called the nuclear envelope. A series of connecting proteins called the LINC (Linkers of the Nucleoskeleton and Cytoskeleton) complex connects the nucleus and the cytoplasm. In humans, mutations in the genes that encode LINC complex proteins cause diseases, such as muscle disease. To understand how these mutant proteins cause muscle disease, we took advantage of genetic tools available in the fruit fly. Humans and flies have similar LINC complex proteins. We reduced the levels of different LINC complex proteins in muscle and observed abnormalities such as loss of nuclear migration and disorganization of microtubules, filamentous proteins needed for muscle contraction. These findings provide insights on the defects of muscle disease so that we can develop therapies in the future.

### **98 - Phoebe Snydersmith**

Major: Psychology

Mentor: Teresa Treat (Psychological and Brain Sciences)

#### *Effect of Feedback on Women's Self-Esteem*

Past work in our lab has shown that college women overestimate how much body-relevant influences and romantic relationships impact the average college woman's self-esteem, and they underestimate how much body-irrelevant influences impact the average college woman's self-esteem. The current work attempts to reduce this misperception by providing college women with feedback on the accuracy of their assumptions. This feedback compares what the participant thinks

influences the average college woman's self-esteem to the data we have previously obtained about what really does. We expect that college women who receive this feedback will be more motivated to change what affects their own self-esteem than college women who do not receive this feedback.

### **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 specifications<sup>1</sup>. 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<sup>2,3</sup>. 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  $37.8 \pm 10.2$  nm to  $12.6 \pm 6.0$  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, stem cells that can be differentiated into retinal cells are a hopeful option to restore sight. However, these new cells must have a support scaffold to remain viable after implantation in the retina. By controlling the microstructure of the scaffold, the cells can be correctly oriented for transplantation. In this

study, chitosan was blended with polyethylene glycol to make the scaffolds. These scaffolds were fabricated by shining a UV light on the liquid solution, with a photomask placed over the solution. The inscribed pattern of dots on the photomask casts a shadow across the polymer, which in turn creates a porous scaffold for implantation. A threshold experiment determined five exposure points that were used for the scaffolds. The retinal cells were seeded onto these scaffolds and were 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 carry out their complex functions are incompletely understood. In our study, we examined the role of LHA leptin receptor (LepR)-expressing neurons in metabolism and behavior. Using viral injections, we deleted LepR specifically from the LHA only and found that loss of LepR signaling in the LHA induces a reduction in both body weight and locomotor activity, as well as increased sleep in the dark cycle when fed high-fat high-sugar diet. Consistent with these observations, we further show that deletion of LepR in the LHA decreases expression of orexin, a wake-promoting peptide, indicating that LepR signaling in the LHA is crucial in maintaining orexin expression. However, despite this reduction, mice lacking LepR in the LHA show increased motivation to work for sugar pellets, which we tested through an operant responding paradigm. Overall, these findings identify the LHA as a key site where the satiety hormone, leptin, acts to control homeostatic behaviors, likely through regulation of orexin signaling.



## **106 - Michael Westphal**

Major: Human Physiology

Mentor: Renata Pereira (Internal Medicine)

### *Deletion of Mitochondrial Protein Protects against Diet-Induced Obesity and Insulin Resistance*

In this experiment, we investigated the role of a particular protein. The protein of interest plays a role in mitochondria shape, as well as function. In mice, as well as our own bodies, there is brown fat and white fat. White fat is generally used for storage of excessive calories, while brown fat provides heat. We deleted our protein exclusively in brown fat in mice. We analyzed the mitochondrial capacities of these knockout mice, as well as their response to a high fat diet. The mitochondria taken from brown fat were noticeably disrupted, and had impaired function. A high fat diet was fed to knockout mice and normal mice. The normal mice showed diabetic symptoms and became obese, while the knockout mice did not gain weight and showed no diabetic symptoms.

## **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 from the 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 osteoporosis, accounting for 1% of the pathologies in the sample, inflammation of the tissue surrounding the bone, 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 bone and their respective joint surfaces. The bony surfaces involved in the hip and foot joints exhibited the highest amounts of DJD cases in the combined set of male and female individuals. 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)

#### *Tuning Chemical Properties and Applications of Metal Complexes by Modifying Ligands*

Understanding reactivity of metal complexes is important since it can be applied to control the performance of metal-catalyzed reactions used to prepare pharmaceuticals and other important organic chemicals. In most cases, ligands, defined as molecules or atoms that bind to metals, play an important role to increase or decrease the performance of reactions or to selectively synthesize products over the others. Furthermore, preparing light-emitting metal complexes is crucial for developing devices such as semiconductors and chemical sensors. In this research, two different ligands containing boron are synthesized to serve as ligands. These ligands were synthesized by modifying the previously reported ligand backbone called TBD, and their metal complexes with Cu were prepared and characterized with various techniques. A metal complex showed remarkable fluorescence in green, while the others are not. Further reactions with MeOH successfully turned the fluorescence to blue. Overall, this research shows the effect of substitution groups in ligands on reactivity of entire complexes including fluorescence.

### **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. Three variables demonstrate a statistically-significant relationship with 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 the Government's Taking of Private Land*

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.