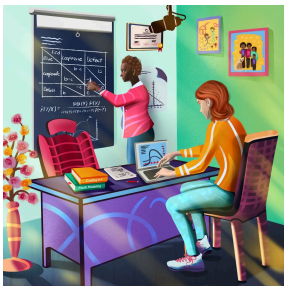
HAMLINE UNIVERSITY

HAMLINE SPRING SHOWCASE
Student Research and Creative Inquiry in the Classroom





Tuesday, May 6, 2025 - 11:30 AM
Anderson Forum

Summer Collaborative Research Programs
Hamline University Honors Program
Center for Teaching and Learning

STUDENT PRESENTERS (poster numbers are indicated by the names)

COURSES (poster numbers are indicated by the course titles)

PROJECTS AND ABSTRACTS

1. Eva Ballard

A Faunal Analysis of 830 Simpson Avenue

ANTH 3970 - Faunal Analysis of 830 Simpson Avenue Instructor: Brian Hoffman

This study seeks to be a follow-up analysis of the faunal remains uncovered at the 830 Simpson Avenue site, located on the campus of Hamline University, following a previous study conducted in 2022 by Sarah Ziskin. The site was occupied from 1881 to 1945 before the house was moved, and a new house was constructed over the site. The faunal remains analyzed were excavated in two field seasons conducted in the spring and fall of 2024. The goal of the analysis was to evaluate the remains to try and determine the prevalence rates of the consumption of mammal and avian food sources, the disposal methods of faunal waste, and the species present and cuts eaten. The analysis provided valuable insights into waste disposal in late 19th and early 20th century Minnesota in a middle class household.

2. Finn Abbott, Natalie Lang, Ava Nebben

Effects of Isolation on Population Genetics

BIOL 1520 - Integrated Concepts of Biology II Instructor: Leif Hembre

Dispersal rates in earthworm populations strongly influence genetic differentiation between populations. Higher dispersal rates cause populations to become well connected, creating lower genetic differentiation (Mathieu et al., 2018). Lower dispersal rates cause isolation, leading to more genetic differentiation resulting in genetic drift (Mathieu et al., 2018). To gather a more full understanding of isolated population genetics, we tested mainland, shoreline, and island earthworm populations. Islands are considered to be a form of habitat fragmentation, which can have a large impact on the genetic variation of earthworms found on an island (Wiley, 2017). Earthworm populations located in isolated areas, like islands, will be more susceptible to inbreeding, which can lead to a smaller pool of available alleles within a population. The lack of gene flow within a population is another area of population genetics that can greatly impact isolated earthworm populations.

3. Madisyn Claseman, Daisy Hernandez, Lindsey Meizo, Hailey Peterson, Sarah Russell

Daphnia and Genetic Distance

BIOL 1520 - Integrated Concepts of Biology II Instructor: Leif Hembre

Daphnia and Genetic Distance explains the research we conducted in order to find out whether or not Daphnia populations from different lakes will be found more genetically distant from one another. Within this research, different samples were collect and put through electrophoresis, in order to determine their genetic makeup. In the end, we created graphs, depicting what happened in the research, and included a discussion where we talked about the steps it took for us to find the answer to our hypothesis.

4. Ryann Hopp, Natalie Morrison, Tristan Popa

Genetic Variation Between Earthworm and Daphnia Populations

BIOL 1520 - Integrated Concepts of Biology II Instructor: Leif Hembre

Earthworms are a hermaphroditic species. This means that each individual have both male and female sex organs and reproduce sexually. Sexual reproduction allows for more genetic variability due to the mixing of genetic material. Worms can also reproduce quickly, contributing to worms establishing

bigger populations quickly, which then contributes to a higher genetic diversity (Piercy, 2023). However, Daphnia, a crustacean animal plankton, generally reproduce asexually, and go through a parthenogenetic cycle. This means that individuals make clones of themselves over and over again. Occasionally, Daphnia will produce sexually, but that only happens so often, and it is not their main method of reproduction (see Fig. 1 for full process). With asexual reproduction, Daphnia populations will go through clonal selection (Hembre, 2006), meaning the clones will compete for resources, leaving only a few clones left. This leads to low diversity within the populations of Daphnia.

5. Claire Siems

Geographical Distance & Genetic Diversity Among Earthworms

BIOL 1520 - Integrated Concepts of Biology II Instructor: Leif Hembre

For this experiment, four distinct earthworm populations around Ozawindib Lake; Bear Paw Point, OZ EastShore, OZ NorthShore, and OZ Island populations were sampled to determine if geographical isolation causes earthworm populations to be less genetically diverse compared to mainland earthworm populations. Oftentimes isolated populations have little to no gene flow, and higher chances of inbreeding, both resulting in the reduction of genetic diversity, so the hypothesis was that the OZ Island population would have less genetic diversity than the other three mainland populations. Electrophoresis of the GPI and PGM genes were carried out and analyzed to determine allele frequencies and heterozygosity levels. The data showed that the OZ Island population and the OZ EastShore population had the lowest genetic diversity, and were the most similar. The OZ Island population saw the disappearance of the F allele for both the GPI and PGM gene loci, the OZ EastShore saw the disappearance of the MS allele, and the OZ Island population had the lowest heterozygosity levels on average. The OZ NorthShore had the most consistent distribution of allele frequencies and the highest heterozygosity levels, and Bear Paw Point had the second most genetic diversity, indicating that mainland populations have more genetic diversity due to gene flow while isolated populations lack genetic diversity due to their geographical isolation.

6. Avery Smieja

Impact of Gene Flow on Genetic Distance of Daphnia Populations in Minnesota Lakes

BIOL 1520 - Integrated Concepts of Biology II Instructor: Leif Hembre

For this experiment four lakes were looked at; two in Minneapolis, Lake Harriet and Lake Bde Maka Ska, and two in Itasca State Park, Long Lake and Mary Lake, to determine if geographical distance correlated with the genetic similarity among the Daphnia populations in these lakes. Daphnia migrate through water, which promotes genetic variation through gene flow, but are too small to swim against currents, and cannot travel independently over land. Therefore the hypothesis was that Daphnia populations that are closer in proximity will have greater genetic similarity compared to more isolated populations. The Daphnia were sampled during the day and from the entire water column of each lake. Then their GPI genotypes were determined through allozyme electrophoresis, which were then used to calculate the allele frequencies and genetic distance (using the Rogers Distance Formula) of the Daphnia between all four lakes. The data showed that Daphnia from lakes that were geographically closer were also more genetically similar, but there was an outlier since Lake Mary and Lake Harriet had the smallest genetic distance, despite being roughly 240 miles apart. The hypothesis was proved to be partially supported; the results imply that genetic differentiation for the GPI gene is not significantly impacted by gene flow.

7. Henry Andrade, Chris Broyles, Tristan Falkowski, Julia Gradilone, Trina Morlock, Musa Tezak

Lake Connectivities Effect on Genetic Distance

BIOL 1520 - Integrated Concepts of Biology II Instructor: Bonnie Ploger

The genetic variation of a species can have a direct impact on the survival of that species. Without genetic variation within a species, it is more vulnerable to changes within its environment. Genetic variation can be impacted by two factors: Gene flow, or interpopulational transfer of genetic material (e.g, new gene from another population), or genetic drift, a change in allele frequency from within a population. Because of its role in the ability of a species to increase its genetic variation, understanding the dynamics of gene flow is fundamental to understanding how populations can adapt to new environments. One species that would be optimal to model this information would be Daphnia (Daphnia Magna). Daphnia reproduce primarily asexually, and (when doing so asexually) by laying large clutches of eggs (De Meester et. al, 2006), and their unique capacity to reproduce sexually and asexually and in large quantities make them perfect for studying the genetic history of a population (Ebert D., 2005)

8. Jace Arca, Alexis Geary, Elliot Martin, Natasha Ovalle, Dani Sihavong

Population Genetics

BIOL 1520 - Integrated Concepts of Biology II Instructor: Bonnie Ploger

Our project focused on genetic diversity between various earthworm populations based on physical barriers within the state of Minnesota. One pair of populations came from the Macalester-Grovel neighborhood and Newell park (about 3 miles apart), which is separated by a city. The other pair of populations came from Bear Paw Point and Lake Ozawindib - North Shore (also about 3 miles apart), which isn't separated by any man-made barriers. We hypothesized that the populations separated by a city would have more genetic distance (i.e. more genetic differences) than the populations separated by a natural environment. We utilized gel electrophoresis in order to identify the alleles of all our earthworm individuals as well as their corresponding genotypes for later calculations. For our gels, we used a dimer known as GPI (glucose-6-phosphate isomerase) and a monomer known as PGM (phosphoglucomutase). By contributing our findings to the compilation of findings from both other current and previous BIOL 1520 classes, we were able to utilize the Rogers Distance equation to calculate the genetic distance between each pair of our populations. We also found research from other similar experiments done throughout the world, from places such as France and Argentina, to see if our findings were supported. We found the populations separated by a city had a higher genetic distance, calculated to be 0.33 with GPI and 0.36 with PGM, while the populations separated by their natural environment had a lower distance, calculated to be 0.103 with GPI and 0.27 with PGM.

9. Maisa Ashfaq, Angelina Kavalenka, Mario Rebollar, Sam Siegel, Raddany Soukdavong

Genetic Distance between Earthworm Populations

BIOL 1520 - Integrated Concepts of Biology II Instructor: Bonnie Ploger

Our poster focused on earthworm populations at different locations. We compared earthworms that were close together, at a medium distance, and then far apart. We wanted to know if there was a correlation between geographic distance and earthworm allele frequencies within different populations. We believed that earthworms that were close together would be more genetically similar compared to those that were further apart. We did this by using the Rogers Distance formula. We then made different graphs to show the similarities between each population at different geographic locations. This gave us a better visual of how the data correlates.

10. AJ Carls, Zoey Danzinger, Addison Dorr, Zoe Medina, Aalyiah Muhammad

Genotypic Variation in Two Populations of Earthworms Separated by a Geographical Barrier

BIOL 1520 - Integrated Concepts of Biology II Instructor: Bonnie Ploger

Genetic drift is being investigated within earthworm populations on Lake Ozawindib Island and Lake Ozawindib East Shore. This is more likely to occur in small populations which makes investigating individual earthworm populations great for this experiment. The understanding of the impact of genetic drift in earthworm populations is limited. To increase the understanding of genetic drift among isolated populations, a study comparing differences in allele frequencies based on the presence of a geographical barrier will provide information on whether on not genetic drift is being observed.

11. Lola Estrada, Devyn Everson, Nadira Omar, Alexi Schneider, Gus Shaffer

Population Genetics

BIOL 1520 - Integrated Concepts of Biology II Instructor: Bonnie Ploger

Our project is about how gene flow was between the transect points in and around Bear Paw Point. Our group compared the allele frequencies of the populations of earthworms. Our hypothesis was, the genetic makeup of earthworms in the Bear Paw Point transect should be similar within each point but different between the farther distance of the transect. The methods we used for our research was Allozyme Gel to show the genetic variability of the earthworms, using the rogers distance equation with the points we chose to compare the data found. We also looked at the biomarkers of the earthworms to see if one of the populations had gone through genetic variation in any way. If there was genetic variation then that means there might be a history of gene flow and adaptation to the different populations of earthworms. Some of our findings went along with the hypothesis we believe, but other data also proved us wrong with our hypothesis.

12. Abdallah Gabr, Graycie Griffiths, Sylvia Soukup

Impact of Gene Flow On The Genetic Distance of Populations of Daphnia Pulicaria

BIOL 1520 - Integrated Concepts of Biology II Instructor: Bonnie Ploger

Daphnia are a planktonic species that are known for their leaf-like legs, used to produce water currents. Daphnia populations can be found in a range of bodies of water, such as a large lake, to a small pool. Because of their clonal reproduction, Daphnia presents a superb tool for qualitative genetic studies which can enhance our understanding of their evolutionary ecology. Interconnectedness amongst Daphnia populations will likely display greater genetic similarity in comparison to two isolated populations- Populations of Daphnia that are geographically nearby one another and are physically connected by flowing water will display greater genetic similarity compared to populations that are nearby one another, but physically isolated by land.

13. David Williams

Population Genetics

BIOL 1520 - Integrated Concepts of Biology II Instructor: Bonnie Ploger

14. Alynna Acosta, Aisha Ali, Analilia Ayala

How do Various Concentrations of Curcumin in Different Forms Affect HCT-116 Cancer Cells?

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Colon cancer is the fourth most common cancer in the United States, with a rate of new reported colorectal cancer cases being 36.0 per 100,000 people. Cancer treatments for colon cancer include chemotherapy, radiation, cryosurgery, or surgery, have all shown promising results in cancer treatment. However, these therapies also harm an individual's health and finances. These problems have increased searches for a much-needed natural cancer therapy to decrease the harmful health impacts and the financial burden it imposes. These aspects guided our research towards the use of curcumin as a natural therapy. Curcumin is a chemical compound found within the plant Turmeric, which carries antioxidant, anti-inflammatory, and anti-cancer characteristics by affecting the growth and survival of cancer cells. Previous studies have shown that cell growth with HCT-116 Cells, a human colorectal cancer cell line, will decrease with the use of curcumin. Curcumin carries properties that prohibit the growth of cancerous cells by interfering with their cell signaling pathways. With the interference, the cells are unable to continue growing, which leaves cells to trigger apoptosis, where they will eventually. This research used serial dilutions of a stock concentration of powder and liquid curcumin to test it as a possible natural cancer therapy. Differing concentrations of therapy were added to HCT-116 cells, and cell metabolic function was determined using a MTS assay. We first used smaller concentrations of our treatment, in which we found a very small decrease in cell concentration as the treatment concentration increased. With this result, we set up another experiment with a higher concentration of our treatment to see if the treatment concentration affects cell metabolic function.

15. Manaal Ahmed, Taylynn Brouwer, Aliyah Robran

Effects of POMx on HCT-116 Colon Cancer Cells Through MTS Assay

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Colon cancer is the third leading diagnosed cancer in the world. Natural therapies can be less harsh on the body and an overall much more enjoyable experience than the typical therapies on the market today. Drawing from other research findings where POMx has shown to induce mitochondrial dysfunction, decrease mitochondrial DNA, and trigger apoptosis (programmed cell death) through the disruption of mitochondrial biogenesis in human oral cancer cell lines. Our goal is to see if pure pomegranate extract (with no additional additives) has similar effects on colon cancer cells, specifically the HCT-116 human colon cancer cell line. The method we implemented in our set of experiments was to incubate HCT-116 cells with various concentrations of POMx for 48 hours. We then performed a MTS Assay test to measure the cell's metabolic activity. Our first experiment yielded results that showed POMx at 1.04-4.16 mg/ml concentration had no effect on the HCT-116 human colon cancer cells. Our next study we are going to increase the concentration of POMx to 4.16-16.66 mg/ml. This study is going to investigate whether POMx can serve as a less invasive, naturally derived alternative for colon cancer treatment by targeting mitochondrial mechanisms to hopefully prevent colon cancer cell growth.

16. Lexi Albert, Aba Moges, Kate Trachsel, Hermela Yemane

Investigating the Effects of Echinacea in HCT-116 Colorectal Cell Line

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Cancer is one of the leading causes of death throughout the world. The current treatments are often costly, inaccessible, and can come with major side effects. This highlights the urgency in searching for new cancer treatments. Our study spans over the semester and focuses on exploring the effects of Echinacea purpurea on the human colorectal cancer cell line HCT-116. Echinacea purpurea is a widely used herbal medicine that has been used to help treat symptoms of illnesses such as the common cold and respiratory infections. In recent studies, Echinacea has also been shown to have direct cytotoxic

effects on both human pancreatic MIA PaCa-2 and colonic COLO320 cancer cell lines. Since it's possible to grow cancer cells in vitro, we treated HCT-116 cancer cell lines with various concentrations of aqueous Echinacea and monitored the effects using an MTS assay which measures cellular metabolism. The preliminary results suggest that Echinacea may influence cancer cells by decreasing their proliferation at low concentrations of the treatment. It's too soon to extrapolate these results and observations beyond the laboratory conditions we worked in. Our research aims to help find holistic treatments that are cost effective and readily available.

17. Blake Anderson, Kathryn Ostgaard, Alejandra Rivera Rios

The Effect of Urtica dioica on HCT 116 Colon Cancer Cells

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Colorectal cancer is one of the most common types of cancer in the United States. Like all cancers, it is the result of a build-up of mutations that have been influenced by environmental and certain genetic factors. Current treatment options include a combination of surgery, chemotherapy, and radiation therapy. These kinds of treatments are often very costly and have significant side effects on patients. There has currently been an interest in evaluating the effectiveness of natural remedies to determine their role in supporting cancer treatment, enhancing quality of life, and improving patient outcomes. A potential natural remedy is Urtica dioica, also known as stinging nettle, which has been shown to have anticancer effects on various types of cancer cell lines, making it a potential natural cancer remedy. Urtica dioica can have antiproliferative and proapoptotic effects on various cancer cell lines. Our goal was to investigate how Urtica dioica impacts HCT-116 colon cancer cells. We also hoped to investigate the dosage and delivery methods of Urtica dioica to HCT-116 colon cancer cell lines and perform MTS Assay to establish metabolic functions that can help us determine cell viability and proliferation. If the MTS Assay shows a decrease in metabolism of the cancer cells, then this research will be an important insight into the potential anticancer properties of Urtica dioica and the effects of natural remedies on cancer cells.

18. Rachel Berg, Mandy Dierks, Siham Omar, Annabella Topliff

Investigating The Impact of Ganoderma lucidum Presence on Colon Cancer Cells

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Ganoderma lucidum, commonly known as the Reishi mushroom, is a fungus that has been utilized by Chinese medicine for centuries. This fungus is becoming increasingly studied due to claims of potential anti-cancer properties. While previous research has examined its effects on various cancer types with an emphasis on breast cancer, there is limited data on its influence on human colon cancer cell proliferation. This study investigates the effects of Reishi mushroom powder on colonic carcinoma cells to evaluate whether it influences the rate of cell division. We treated cultured cells from the HCT 116 line with various concentrations of Reishi mushroom powder and assessed cellular metabolism using MTS assays. Our research aims to fill the gap in the existing literature by focusing specifically on colon cancer, which is a leading cause of cancer deaths in the United States. If successful, our research could solidify Reishis's role in cancer therapies, contributing to developing alternative, affordable cancer treatments.

19. Heather Chandler, Sapphire Her, Milla Infante Puente

In Vitro Effects of Acacia Gum Powder in HCT-116 Colorectal Cancer Cells

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Colorectal cancer is one of the five most commonly diagnosed cancers in the world. Most cancer treatment options not only exhibit detrimental side effects, they are costly as well. Thus, it is imperative to find other solutions that decrease side effects on patients as well as reducing costs. One possible treatment is Acacia Seyal Gum extract. Acacia Seyal is a gum found in Africa and the Middle East. It has previously been used as a natural remedy promoting immune health and antioxidant properties. Previous studies have shown that Acacia Seyal Gum causes cancer cell death in breast cancer, as well as preventing or reducing the growth of mammary tumors. Due to these results, we decided to test the cytotoxicity of Acacia Seyal gum extract on HCT-116 colorectal cells. A variety of treatment concentrations were used–50µg/mL, 100µg/mL, 200µg/mL, and 400µg/mL that correspond to previous studies. Our results contradicted what previous literature had shown related to the cytotoxicity of Acacia Seyal. Acacia Seyal at these concentrations, caused an increase in cell activity/metabolization of HCT-116 colorectal cancer cells shown by the increased light absorbance on an MTS assay. These results suggest that Acacia Seyal Gum at this concentration exhibits no cytotoxic effects on HCT-116 cells.

20. Jordyn Campbell, Chloe Janssen, Reaa Pandey

Investigating the Anticancer Effects of Aged Garlic Extract on HCT-116 Colon Cancer Cells

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Colorectal cancer is one of the most prevalent and deadly cancers worldwide, coming in as the number 3 most prevalent cancer in the world in 2023. Treatments like chemotherapy or radiation therapy are common but are often associated with significant side effects that cause more harm to people. Another common issue is it is tough to find a cure for cancer because the cells tend to adapt to the drug that is being given to the person, and through this, the cancer cells can evade or escape the effects of the drug. Because of these issues regarding cancer treatment, we wanted to explore a more natural route to treating cancer, a phenomenon that has grown in popularity due to the intense side effects of standard cancer therapies. We explored the potential anti-cancer effects of aged garlic extract on HCT-116 human colon cancer cells. During the first part of our experiment, we plated cells at 2000 cells per well and made a 10mg/mL stock solution of aged garlic extract. We performed a ten-fold serial dilution to obtain treatment concentrations of 1ug/mL, 10ug/mL, 100ug/mL, and 1000ug/mL, which were added to our plated cells in replicates of 6. An MTS assay was performed to assess cell viability. Our initial data revealed little to no effect of the treatment on cell viability. Based on this, our next steps are to perform a 1:2 serial dilution from our new stock solution of 50mg/mL to try and yield more conclusive results.

21. Mirnesa Delic, Sierrah DiCosimo, Riley Knoss

Moringa vs. Colorectal Cancer: Leaf it to the Miracle Tree

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Cancer is a group of diseases where cells in the body grow and divide uncontrollably, often forming tumors due to a series of mutations at the cellular level. Colorectal cancer, in particular, is a deadly cancer variant, characterized as having the second-highest cancer mortality rate in the United States. Moringa oleifera, or simply Moringa, is a native tree found in Southwestern Asia, often referred to as the “tree of life.” Different parts of the moringa tree have been effective at inducing apoptosis in breast cancer and liver cancer cells. In our study, we tested the potential benefits of different Moringa leaf tea concentrations against HCT-116 colorectal cancer cells. We did so by plating HCT-116 cells in a 96-well plate, and added varying concentrations from 0µg/mL to 3200µg/mL of Moringa leaf tea. The cell

metabolic rate was visualized with the MTS assay and quantified with a plate spectrophotometer. Based on our study, we found that increasing the concentration of Moringa leaf tea decreases cancer cell viability.

22. AJ Escalante, Eren Rawn, Brianna Thompson

In vitro Exploration of A. muricata Effect on HCT-116 Cells

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Colorectal cancer remains a major global health challenge, with high incidence and mortality rates. Given the limitations and adverse side effects associated with conventional therapies such as chemotherapy and radiation, there is increasing interest in exploring plant-based, non-toxic, affordable alternatives. Annona muricata, also known as soursop is a tropical plant traditionally used for its anti-inflammatory properties, has recently gained attention for its potential anticancer effects. Soursop contains bioactive compounds such as acetogenins and alkaloids, which have been shown to induce apoptosis, reduce oxidative stress, and inhibit cancer cell proliferation in SCC-115 carcinoma cells. Colorectal cancer cells were used because colorectal cancer has a high global incidence rate, and studying these cells helps assess soursop's potential against a cancer type with significant impact and limited treatment options. This study investigates the cytotoxic and antiproliferative effects of A. muricata extract on HCT116 human colorectal cancer cells. Cells were plated at a density of 2000 cells/well and allowed to incubate for a week prior to the addition of treatment solution. An MTS assay was used to assess the metabolic activity and viability of HCT-116 cells after 72 hour time treatment with varying concentrations (10-80 μg/mL) of soursop extract. Control groups included no-cell wells and untreated cells. Initial findings showed that all tested concentrations reduced cancer cell density compared to the control, in a dose dependent manner.

23. Lucy Ehlers, Pricilla Lopez-Serrano, Alisson Martinez Villa

Effect of Artichoke Leaf Extract on HCT-116 Human Colon Cancer Cells

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Colon cancer is one of the most common and deadly cancers worldwide, with rising rates in younger adults. This study investigates the potential anti-cancer effects of artichoke leaf extract on HCT-116 human colon cancer cells. Having been traditionally used for its medicinal properties, including liver protection, anti-inflammatory effects, and cholesterol reduction, artichoke extract is widely known and widely used. Recent studies have suggested that artichoke leaf extract may possess anti-cancer properties, making it a promising candidate for further cancer research. Our research aims to use powdered artichoke leaf extract as a natural cancer therapy. We hypothesized it would inhibit cancer cell growth. In our initial experiment, cells were treated with 1.5, 3, 6, and 12 mg/mL concentrations of the extract, followed by an MTS assay to assess cell viability and metabolic activity. Unexpectedly, these concentrations appeared to stimulate cell growth rather than inhibit it. To address this, a second experiment was designed using higher concentrations, preparing a 300 mg/mL stock with serial dilutions of 90, 45, 22.5, and 11.5 mg/mL. By increasing the dosage range, we aim to determine whether higher concentrations more effectively suppress colon cancer cell proliferation.

24. Ashley Grabau, Hannah Lemon, Tshuaj Yangwaue

Investigating the Effects of Various Ginger Concentrations on DLD-1 Colorectal Cancer Cells

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

Ginger is a natural spice that comes from the root of the Zingiber officinale plant and has been used in Chinese and Indian medicine for thousands of years. 6-gingerol is one of the main phytocompounds found in ginger and possesses various anti-inflammatory and antioxidant properties. It has recently been discovered that 6-gingerol also has many anti-tumoral properties, thus preventing cells from experiencing uncontrolled growth and proliferation. Given this finding, we wanted to determine if ginger would affect the metabolic activity of DLD-1 human colorectal cancer cells in vitro. Previous studies have found that ginger is effective at reducing the proliferation of colorectal cancer cells in vitro, but this research has primarily focused on its effect on HTC-116 cells. Our goal was to extend upon this previous knowledge by testing the effect of ginger on DLD-1 cells, a form of adenocarcinoma that arises in the epithelial tissue of the colon. To investigate this, we plated DLD-1 cells in culture, added varying concentrations (100, 200, and 400 micrograms/mL) of ginger powder, and used an MTS assay to assess metabolic activity. We hypothesized that higher concentrations of ginger powder would have a greater ability to reduce the metabolic activity of DLD-1 cells. Initial results showed no significant differences in cell survival for cells treated with ginger powder compared to cells in control conditions. Future directions for this study could include increased replicates and testing the effect of ginger on non-cancerous human cells. Given its historic use in various cultures to treat various symptoms and minimal side effects that would improve the quality of life for cancer patients, ginger is a promising treatment option worth continuing to explore.

25. Valentina Hernandez, Syd Mann, Maria Marvin, Sophia Warner

The Effects of Ginkgo Biloba Leaf Extract on HCT-116 Human Colorectal Cancer Cells

BIOL 3060 - Principles of Cell Biology Instructor: Jodi Goldberg

The Ginkgo biloba tree, or alternatively known as a maidenhair tree, is native to China, but can also be found in Korea and Japan. It is a deciduous gymnosperm tree in the class Ginkgoopsida–an ancient line of trees that are similar to fossils from 270 million years ago. Ginkgo biloba leaf extract (GLE) is created from the dried, fan-shaped leaves of the Ginkgo biloba tree. The leaf extract, or referenced Yin Xing Ye in China, has been used in Traditional Chinese Medicine (TCM) for centuries to improve circulation, enhance cognitive function, and treat heart and lung conditions. However, in modern medicine, GLE has been researched for potential anti-cancer properties and to treat chemotherapy-associated toxicity. GLE contains flavonoids and terpenoids, which are antioxidants that protect cells from damage and prevent free radicals and is the main driving force for the properties of GLE. Flavonoids have been found to prevent different types of cancer such as: gastric, breast, prostate, and colorectal. Furthermore, GLE has been found to impact lung, hepatocellular carcinoma, gastric, breast, colorectal, and cervical cancer by stimulating apoptosis and inhibiting the division of cancer cells. To determine the effect of GLEs on HCT-116 human colon cancer cells, GLE was incubated with cells at 2.4, 1.2, and 0.6 mg/ml. This experiment found little change in the HCT-116 cells; however, further research shows that a higher concentration of GLE with HCT-116 cells have had more of an impact by inducing apoptosis. Thus, in the following experiment we incubated GLE with cells at 24, 12, and 6 mg/ml.

26. Teagen Bergquist

Developing a Protocol to Test for Cell Death Caused by Apoptosis

BIOL 3970 - Independent Study in Biology Instructor: Jodi Goldberg

Cells die via several mechanisms. One such way is apoptosis, a type of programmed cell death. During apoptosis, the cell condenses its chromosomes, causing them to shrink. The nucleus then fragments, and DNA soon follows. However, in gel electrophoresis, the fragmentation of DNA can be used to

determine if a cell has died via apoptosis. Gel electrophoresis works using positively and negatively charged electrodes at opposite ends of a gel submerged in fluid. DNA is negatively charged, so the DNA strands move toward the positive end when a charge is run in the fluid. However, different strand lengths of DNA will move either faster or slower based on their size. Smaller fragments move faster, and larger fragments move slower. Because of this, the gel will have different bands representing different-sized DNA strands. Cells that have died by apoptosis are determined by showing a DNA ladder on gels, showing the different-sized DNA fragments. This semester, I aimed to develop a relatively cheap and quick protocol to test for cell death in under three hours. Once finalized, this protocol could be used to measure apoptosis by students enrolled in the BIOL 3060 Principles of Cell Biology lab section. I found that a starting concentration of cells between 0.5-1x10^6 cells/mL is required to visualize fragmented DNA bands in a gel effectively. I treated cells with multiple concentrations of H2O2 to induce apoptosis due to previous research indicating that H2O2 causes apoptosis in cell lines. I found a protocol used to lyse cells that didn't need any expensive enzymes or take a whole day to run. The gels that were run showed DNA and RNA bands, indicating I did effectively lyse the cells. Unfortunately, I could not thoroughly test this protocol due to treatments failing to induce apoptosis.

27. Hannah Aldrich, Cece Chmelik, Elizabeth Evans

Searching for Antibiotic Producing Microbes in Urban Soil

BIOL 5550 - Microbiology Instructor: Betsy Martinez-Vaz

With the ever growing antibiotic resistance crisis, bacteria are becoming increasingly resistant to current antibiotics. Discovering new antibiotics is crucial to keep up with the microbial resistance. The Tiny Earth Project is an international initiative designed for students to search for new antibiotics in understudied environments that have the potential for antibiotic producing microbes. Previous research indicates that human population density and urban land use shape the microbial diversity and abundance in soil. It has also been found that there is an increase in bacterial diversity in soil near areas of high vehicular emissions. We hypothesized that a soil sample taken from a busy intersection high in foot traffic, will result in an abundance of antibiotic producing microbes. To test this we collected a soil sample near the loon statue at the intersection of University and Snelling in Saint Paul. This area is next to Allianz Field which attracts soccer fans resulting in high levels of foot traffic. It is also a busy transportation corridor that includes light rail, multiple bus lines, and personal vehicles. After collecting the soil sample, we plated the diluted soil and grew bacterial colonies. The resulting isolates were plated on agar containing lab-safe relatives of pathogens known to have antibiotic resistance. Zones of inhibition produced in these assays were used to test for antibiotic activity. One antibiotic producing isolate was sent for 16S rRNA sequencing and found to be the bacteria Staphylococcus hominis. Finding S. hominis in our sample does support our hypothesis but there is more work to be done to further understand the mechanism of its antibiotic activity. Understanding how this bacterium creates a zone of inhibition and what pathogens it is effective against is useful in finding new potential sources of antibiotics to help with the antibiotic resistance crisis.

28. Daniela Garcia Tellez, Precious Keke, Nikki Olund, Jackson Wille

Isolation and Characterization of Antibiotic Producing Bacteria in Ornamental Fish: *Exiguobacterium Aurantiacum*

BIOL 5550 - Microbiology Instructor: Betsy Martinez-Vaz

The global rise of antibiotic-resistant bacteria has created an urgent need for the discovery of novel antimicrobial agents. The Tiny Earth Project addresses this by engaging college students in research to

combat antibiotic resistance by discovering new effective antibiotics. In this study, we investigated the potential of discovering antibiotic producing bacteria in an ornamental fish tank. As an enclosed aquatic environment with diverse microbial communities, fish tanks represent a unique and largely untapped source of potential antibiotic-producing bacteria. The primary objective was to discover novel isolates with inhibitory activity against common bacterial pathogens, thereby contributing to the expanding field of natural product-based drug discovery. Sample swabs were collected from a Pleco suckerfish tank from the tank rocks, fish houses, and Pleco fish bodies before being cultured on media plates. Bacterial isolates were screened for antimicrobial activity using cross-streak and agar well diffusion assays against ESKAPE pathogen relatives, including Escherichia coli and Staphylococcus aureus. Four bacterial strains demonstrated inhibitory activity against ESKAPE pathogen relatives, with one distinct bacterial isolate being investigated further through 16S rRNA sequencing and biochemical characterization tests. Preliminary findings indicate the presence of multiple bacterial isolates exhibiting significant antimicrobial effects, suggesting that ornamental fish tanks harbor previously uncharacterized strains with the potential to produce novel antibiotics. A bacteria that was similar to our potential antibiotic producer was Exiguobacterium aurantiacum, which is a gram positive bacterium. This study demonstrates the value of exploring unconventional environments for antimicrobial discovery and highlights the potential of everyday ecosystems to contribute meaningfully to the fight against antibiotic resistance.

29. Teagen Bergquist, Kate Landsteiner, Kong Yang

Discovery of new antibiotics: Do earthworm guts contain antibiotic-producing microbes?

BIOL 5550 - Microbiology Instructor: Betsy Martinez-Vaz

The emergence of antibiotic-resistant bacteria poses a threat as well as challenges to healthcare and global/public health. As antibiotic resistance arises, so does the efficacy of antibiotics decline, emphasizing an urgent need for new discoveries and the development of antimicrobial medications. In this project we aim to find a new antibiotic producer. There are several strategies used to discover new antibiotic-producing bacteria. Metagenomics, the process of studying the genetic material taken from an environmental sample of organisms, can help researchers to identify antibiotic producers from the natural world without having to culture them in a lab setting. Due to high microbial diversity, soil is one of the most common places to find antibiotic producers, but what about the worms living in the soil? Earthworms constantly interact and move through the soil. Previous studies have shown that the gut microbiome of earthworms is similar to that of the soil surrounding it, giving earthworms the potential to harbor antibiotic-producing bacteria. For this study, we used metagenomics to look at an isolated bacteria that came from the gut microbiome of earthworms from Tennessee. From these plates, we identified four antibiotic producers, all killing gram-negative bacteria P. putida and E.aera. We chose one isolate for 16S rRNA sequencing, and it was found to be a gram-negative bacteria, Enterbacter ludwigii. We used several biochemical tests to further help characterize this bacteria, such as catalase tests, oxidase tests, and gram staining. We also used another database, Antismash, from our 16s rRNA sequence to discover potential processes by which our bacteria produces antibiotics. We tested the resistance of our bacteria to antibiotics such as penicillin, ampicillin, and tetracycline using the Kirby-Bauer method. The next step is to test whether our bacteria produces biofilms and ferments glucose.

30. Tori Hutchinson, Chloe Reyes, Joey Roberts, Mia Sedgwick

Biofilms: Potential Antibiotic-Producing Bacteria in Your Home

BIOL 5550 - Microbiology Instructor: Betsy Martinez-Vaz

Tiny Earth is a global research initiative that empowers undergraduate students to discover new antibiotic-producing bacteria to help combat the growing crisis of antibiotic resistance. This rise in resistance has been making it more difficult to treat harmful bacterial infections that affect populations all around the world. Bacteria can be found anywhere — in hospitals, outside, and even in your home. This research aims to find antibiotic-producing bacteria to combat antibiotic resistance, specifically in biofilms found around residential drains. Research on home biofilms and possible antibiotic-producing bacteria has not been published, which makes this research novel and potentially beneficial for the field of microbiology. We hypothesize that residential drain biofilms will have a diverse microbial community that contains antibiotic producers because they are a hotspot for bacteria. Samples were collected from various drains in the Hamline Apartments and cultured on ½ LB and PDA plates to isolate microbial colonies. We tested our colonies against three different relatives of harmful pathogens to determine our samples' antibiotic activity. Following this, we found positive results for antibiotic activity against most of the pathogens, suggesting that we did have antibiotic producers in the home biofilms. Furthermore, 16S rRNA sequencing along with Gram-staining confirmed the identity of our antibiotic producer to be Pseudomonas aeruginosa. We performed further testing such as Kirby-Bauer and nutrient availability tests to determine the characteristics of P. aeruginosa and how these characteristics fit into antibiotic production. Overall, our results suggest that home biofilms have the potential to house bacteria that can produce antibiotics that kill harmful pathogens, as well as offer insight into novel antibiotic discovery.

31. Tate Johanning, Sophia Schlink, Pa Hok Vang

Screening for Antibiotic-Producing Bacteria in Soils from University Landscapes

BIOL 5550 - Microbiology Instructor: Betsy Martinez-Vaz

The emergence of antibiotic-resistant pathogens coupled with lagging antibiotic discovery poses a serious public health concern. With an increase in the prevalence of multidrug-resistant bacterial outbreaks, innovative solutions for drug discovery and development are urgently needed. The purpose of this project was to investigate the presence of antibiotic producing bacteria in soils from unique urban environments with varying levels of associated plant biodiversity. We hypothesized that bacteria and antibiotic producers would be more abundant in soils sampled from environments with high levels of associated plant biodiversity, and lower when sampled from those with homogenous plant communities. Topsoil samples were collected from a college campus; one from a campus garden, and the other from a grass lawn. These samples were diluted in 1X PBS and plated on LB+cycloheximide and PDA+cycloheximide to determine microbial counts (CFU/g of soil) and assess bacterial diversity. Plate counts indicated that garden samples had, on average, higher microbial counts ranging from 8.0 x 10^4 to 7.2 x 10^7 colony forming units per gram of soil, whereas the grass lawn sample ranged from 9.0 x 10^4 to 4.3 x 10^6 colony forming units per gram of soil. Both garden and grass lawn samples displayed high levels of morphological diversity. S. epidermidis, E. coli, and P. putida tester strains were used to screen for antibiotic activity of our bacterial isolates. An isolate from our garden soil sample showed antimicrobial activity against all three tester strains, and 16s rRNA sequencing identified our organism to be closely related to Pseudomonas germanic. In-silico Antismash data predicted three compounds with potential antimicrobial activity: 3-thiaglutamate, lokisin, and hydrogen cyanide. Future research on this isolate will focus on the isolation and investigation of these theorized antimicrobial compounds.

32. Cailey Price, Lily Ramsdell, Olivia Tobin

Investigation of Antibiotic-Producing Bacteria in Soil from Storm Drain Runoff

BIOL 5550 - Microbiology Instructor: Betsy Martinez-Vaz

The Tiny Earth Project is a worldwide engagement project addressing the pressing issue of the antibiotic resistant crisis in the healthcare field. As a collective, students are performing experiments to identify new antibiotic producers that are found in natural settings. Multiple methods are used to find new antibiotic resistant bacteria, one way is bacteria from natural environments. Previous research shows increased antibiotic producing bacteria in wet soil environments making storm drains a hotspot of antibiotic resistance. The goal of this experiment was to find new antibiotic resistant bacteria. We hypothesized that the bacteria we collected would show a diverse abundance of antibiotic producing microbes. Our methodology consisted of soil collection from storm drain runoff in Cottage Grove, MN, which was then diluted and plated on PDA and TSA agar plates. B. Subtilis, P. Putida, and S. Epidermidis Eskape pathogens were diluted and spread, our bacterial isolates were plated on the Eskape pathogens. Zones of inhibition were used to determine antibiotic resistance. 16S rRNA PCR, anti smash, gram staining and oxidase tests were used as confirmation tests. We discovered 4 total antibiotic producers, 3 B. subtilis resistant, and 1 P.putida resistant. We expect that with continuation of our experiment we will find at least more antibiotic producers. 16s rRNA sequencing showed the highest similarity with Pseudomonas hamedanensis. This bacteria is classified as a gram negative bacteria. This was confirmed through gram staining and oxidase testing. Antismash was also used to look within the genomic regions of our bacteria, showing us different regulators found in the different regions of the bacteria. We will continue to investigate the sensitivity of our bacteria. Our findings suggest that there is an abundant amount of antibiotic resistant bacteria found in the natural environment.

33. Hannah Aldrich, Tori Hutchinson, Haylie Magoon, Jesse Wartnick

Site-Directed Mutagenesis of DUF2_9BURK: D72K and C132R

BIOL 5900 - Molecular Cell Biology Instructor: Betsy Martinez-Vaz

Metformin is a drug frequently used to treat Type 2 Diabetes Metformin and its main degradation product guanylurea are common pollutants in wastewater, leading scientists to search for ways to degrade metformin, the most promising of which have been proteins that are part of the Domain of Unknown Function family 1989 (DUF1989). This family of proteins includes carboxyguanidine deiminase (CgdAB), which is involved in a pathway that has been found to successfully degrade metformin. CgdAB catalyzes the reaction that converts carboxyguanide to allophanate, leading to the degradation of metformin. The protein being explored in this study is called DUF2_9BURK and is part of the DUF1989 superfamily. We looked into the importance of specific amino acid residues in this protein and performed site-directed Quikchange mutagenesis to create two mutations D72K and C132R using primers we designed based on the given protein sequence. Following mutagenesis, we transformed the plasmids into supercompetent E. coli cells, which we sent for sequencing to confirm mutagenesis. We also performed follow-up testing to determine if the mutated protein was still able to produce ammonia, one of the byproducts of the proposed pathway for the degradation of metformin. We hypothesized that our mutations would decrease the specific activity of the protein because the residue changes would alter the function of the protein to hold the zinc metallocenter and protonate the surrounding H2O molecules.

34. Nihal Abdi, Lucy Ehlers, Anna Ludbrook, Ida Ky

Identifying Key Amino Acids of DUF2_9BURK Through Site-Directed Mutagenesis

BIOL 5900 - Molecular Cell Biology Instructor: Betsy Martinez-Vaz

Metformin is a widely prescribed medication for type II diabetes, and has recently shown promise in treating other conditions. However, it is a significant pollutant in wastewater, prompting researchers to investigate the degradation pathway and identify new enzymes. Carboxyguanidine deiminase was identified as a key component of this pathway, enabling bacteria to break down guanidine into ammonia and carbon dioxide—both of which are environmentally harmless. This enzyme belongs to the DUF 1989 superfamily, a group of proteins whose functions remain largely unknown. Our research aims to use site-directed mutagenesis to determine key amino acids that are important for the function of DUF2_9BURK, a member of this family. This will provide insight into its function and evolutionary relationship to enzymes involved in metformin degradation. We focused on two mutations: changing aspartic acid (D) at position 72 to tryptophan (W), and cysteine (C) at position 149 to methionine (M). Both amino acids are thought to be crucial for enzyme function, either by binding to the zinc found in the active site or acting as a base catalyst to deprotonate water. Computational modeling of the wild-type and mutant amino acids suggested that both mutations would reduce the enzyme's activity. To test this hypothesis, we designed primers for both mutants, performed site-directed mutagenesis using the QuikChange II system, followed by DNA sequencing to verify the mutations. We found that only the D72W mutation was successful. The D72W mutant was purified using His-Tag nickel affinity chromatography, with SDS-PAGE electrophoresis confirming the purification. Enzymatic activity was measured by the ammonia release in a Berthelot assay, showing that the D72W mutant had lower specific activity, indicating that D72 is essential for the catalytic activity of the enzyme. These experiments are key to understanding the functions of the DUF1989 superfamily proteins and their relationship to metformin-degrading enzymes.

35. Carter Arhart, Nancy Benedict, Jordyn Campbell

Essential or Expendable? Using Site-Directed Mutagenesis to Identify Essential Amino Acids in a DUF1989 Superfamily Enzyme

BIOL 5900 - Molecular Cell Biology Instructor: Betsy Martinez-Vaz

Metformin is a widely prescribed pharmaceutical drug for treating type II diabetes, however, the human body does not fully metabolize this drug leading to the excretion of toxic guanidine-based byproducts that contribute to wastewater pollution. The proposed microbial degradation pathway for metformin shows carboxyguanidine deiminase (CgdAB), transforms carboxyguanidine to allophanate, a compound subsequently broken down into carbon dioxide and ammonia. CgdAB belongs to the DUF1989 superfamily, and is characterized by its ability to catalyze metal-assisted hydrolysis of a biguanide substrate, alongside six highly conserved amino acids. Many DUF1989 homologs contain identical conserved residues, suggesting a potentially similar catalytic function. In this study, we aimed to investigate the functional role of these conserved residues on an uncharacterized enzyme in the DUF1989 superfamily. We conducted site-directed mutagenesis on DUF2_9BURK, focusing specifically on a cysteine residue at position 149 (C149), which we hypothesized to be essential for enzymatic activity. The DUF2_9BURK gene was extracted from transformed E. coli cells and the plasmid was purified using a charged resin. Next, gel electrophoresis with restriction enzymes was performed to verify successful plasmid isolation. Site-directed mutagenesis was performed using the QuikChange protocol with custom primers to introduce the C149F mutation. The resulting construct was transformed into super-competent E. coli cells for protein expression. Berthelot assays assessed enzyme activity by quantifying ammonia production in mutant versus wild-type proteins. We found

the mutant enzyme exhibited activity levels below the detection threshold, indicating that C149 may be critical for the catalytic function of DUF2_9BURK. Alternatively, limited protein expression or yield could have contributed to low assay sensitivity. These findings support the hypothesis that conserved amino acids may play a role in microbial degradation of metformin-derived guanidine compounds. Our study highlights the potential of DUF1989 family members in environmental detoxification and strengthens our understanding of conserved residues in guanidine-degrading enzymes.

36. Anna Boehme, Pricilla Lopez-Serrano, Grace Tesmer

Mutagenesis of DUF2_9BURK to Investigate Enzymatic Activity at D72Q

BIOL 5900 - Molecular Cell Biology Instructor: Betsy Martinez-Vaz

Understanding the enzymatic functions of uncharacterized protein families is essential to advancing our knowledge of microbial biochemistry. The DUF1989 protein family, first identified in 1989, remains largely uncharacterized, with only one known member. DUF2_9BURK, an uncharacterized member of this family, implicated in the microbial breakdown of guanidinoacetate. This project investigates the functional role of a conserved aspartic acid residue at position 72, hypothesized to activate a water molecule essential for hydrolysis of the guanidinoacetate. To test this, we mutated Asp72 to glutamate and assessed changes in enzymatic activity using bioinformatics, mutagenesis, protein purification, and enzymatic assays. The D72E mutant showed no detectable ammonia release in Berthelot assays, in contrast to the wild-type, indicating a significant loss of function. These findings suggest that Asp72 is critical to catalysis and contribute to a better understanding of the DUF1989 family, highlighting how targeted residue analysis can reveal key insights into protein function relevant to broader biochemical systems.

37. Luke Blackman, Stefany Huerta-Ochoa, Gaoshuapa Thor

Characterizing an Enzyme in the DUF 1989 Superfamily: DUF2_9BURK

BIOL 5900 - Molecular Cell Biology Instructor: Betsy Martinez-Vaz

The Domain of Unknown Function(DUF) 1989 family has many uncharacterized enzymes. Guanidinoacetate hydrolase(DUF2_9BURK) is an uncharacterized enzyme in the DUF 1989 family, and by mutating it, we could start to characterize this enzyme. When mutating the amino acid arginine at position 110 to lysine, we hypothesize there will be a decrease in enzyme activity due to fewer amine groups and less stability in aligning the substrate. First, the plasmid was extracted, primers were created, site-directed mutagenesis was performed, the mutation was transformed back into cells, which were plated on antibiotic agar and then later tested for enzyme activity. All plates showed growth, and samples were collected for DNA sequencing. The DNA sequence confirmed there's a correct mutation of arginine to lysine at position 110, and the peaks in the chromatography were clean, indicating great DNA detection. After purifying the protein, enzyme activity was tested using the Berthelot assay, which showed that our mutant had significantly less ammonia release than the wild type. Based on the results, it can be concluded that creating a mutation in the amino acid arginine at position 110 to lysine does negatively affect enzyme activity, which may have been due to the importance of arginine in stabilizing the substrate and holding together the two subunits of DUF2_9BURK.

38. Sara Dooley, Sophia Schlink, Aidan Voravongseng

Probing the Active Site of DUF2_9BURK: Site-Directed Mutagenesis of C213S

BIOL 5900 - Molecular Cell Biology Instructor: Betsy Martinez-Vaz

The DUF1989 superfamily consists of carboxyguanidine deiminase (CgdAB) and many other uncharacterized proteins. One such protein, DUF2_9BURK, is known to have guanidinoacetate hydrolase activity, but it's precise structure and catalytic activity remains unresolved. This research aims to examine the catalytic mechanism and substrate specificity of DUF2_9BURK via in-silico and in-vivo experiments. Bioinformatic analyses were conducted to predict the active site and structure of DUF2_9BURK. Site-directed mutagenesis was performed to construct mutants in amino acid Cys-213, which was predicted to be a metal chelator in the enzymatic active site, coordinating the zinc metal for catalysis. The mutant created was C213S. The wild type and mutant enzymes were purified using His-tag affinity chromatography. Enzyme activity was assessed by measuring ammonia release with Berthelot assays. The results showed that the C213S mutant had no noticeable activity compared to the wild type DUF2_9BURK enzyme.

39. Claire Kerber

Final Podcast Project on Crime & Justice

CJFS 1120 - Crime and Justice in America Instructor: Caity Curry

By analyzing the Batman universe's police and prison systems, this project, set in a podcast format, will compare them to real-life systems. This podcast answers whether or not our real-life systems are on par with what is often described as by far the worst fictional criminal justice system. It brushes over a brief introduction and history of the Batman universe to keep the viewers up to date, while then explaining how certain criminal justice concepts like recidivism, the blue wall of silence, and the social construction of crime relate to both this fictional world, and our real one. It then draws comparisons between the Gotham City prison systems (Arkham Asylum and Blackgate Penitentiary), and the real ones they were based on (Danvers State Insane Asylum and Alcatraz Federal Penitentiary). The project is set up as realistically as possible for the YouTube podcast format, completed with video chapters and an advertisement break in the middle.

40. Abbie Chandarath

Comparing Government Control and Social Media's Role in Political Mobilization: College Students' Ability to Organize Protests in China and the United States

CJFS 3990 - Criminal Justice Internship Instructor: Sarah Greenman

How do varying levels of government control over social media platforms affect the ability of college students to organize and mobilize for political protests internationally in China compared to the relatively freer environment in the U.S.? Strict government regulation in China makes it extremely difficult for students to organize and plan protests by restricting access to uncensored material, stifling dissent, and stepping up surveillance. By encouraging open communication, quick information sharing, and more opportunities for network development, the comparatively more liberal social media environment in the United States, on the other hand, encourages increased political mobilization. In this research, I'll be demonstrating the disparate contexts of China and the United States. Different degrees of governmental control over social media platforms have a substantial impact on college students' capacity to plan and mobilize for political demonstrations.

41. Megan Aurandt, Kaw Law Eh Moo, Nasra Shube, Madeleine Tengel, Sulin Vang

Teamwork or Greed: What dominates pro-social behavior

ECON 3750-1/ MKTG 3755-1 - Behavioral and Experimental Economics Instructor: Ryan McWay

This study examines what influences an individual's decisions to invest in socially beneficial actions. It utilizes the prisoner's dilemma game to create an experiment that will generate data which will then

be transformed into an ordinal logit model. Our results will reveal whether our stated independent variables will have an effect on whether people choose group benefit or self preservation. The Hamline community is the primary sample pool for this experiment which will allow a unique examination at the implications of discipline of study on one's behavior during the prisoner's dilemma. Additionally, it will be interesting to examine the implications of one's family income, as well as one's political preferences. We intend to investigate how gender dynamics shape decision-making, such as whether mixed-gender pairs demonstrate higher levels of cooperation compared to same-gender pairs. The analysis for this experiment will implement the regression model, as it will allow for multi-variable analysis.

42. Jasper Gresback, Anisa Mohamed, Jack Windschitl, Amanda Xiong

The Decoy Effect

ECON 3750-1/ MKTG 3755-1 - Behavioral and Experimental Economics Instructor: Ryan McWay

The decoy effect, sometimes known as asymmetric dominance, is simple. Here is an example: when you get to the concession stand, you see the small costs $3, the medium is $6.50, and the large is $7. You don't really need a whole large popcorn, but you end up buying it anyway because it's a much better deal than the medium. This simple example perfectly encapsulates the spirit of asymmetric dominance, and I am sure you can begin to see how this concept is used by companies world wide ranging from the motor vehicle industry all the way back to movie popcorn, such as in the example.

43. Madisen Borek, Abby Holst, Mckenna Kulp

Implementation of a Daily Static or Dynamic Stretching routine to Increase Stability and Flexibility in the lower Extremities

EXSC 3300 - Research Methods in Exercise Science Instructor: Lisa Stegall

PURPOSE: The purpose of our study was to compare the impacts of implementing a structured static versus dynamic stretching program on female athletes to improve the flexibility and stability in their lower extremity muscles. When it comes to women participating in competitive sports, they are two to eight times more likely to tear their ACLs, in comparison to their male counterparts (NLM). We wanted to specifically study the hamstrings, hip flexors, and quadriceps muscle, which have a large part in this injury and many other injuries that female athletes face. When researching the methods that could be implemented to prevent these injuries, we found a focus on stretching to be the educated answer. Stretching prevents injury by improving flexibility and range of motion, increasing blood flow and oxygen delivery to muscles, and reducing muscle tightness and soreness, preparing the body for activity and reducing the risk of strains and sprains (Mayo Clinic). Due to the lack of research done specifically on females and the higher risk of lower extremity injuries, because of a higher Q- angle, we decided to pick only female subjects to determine the best type of stretching to be used to prevent these injuries. METHODS: 8 participants underwent 3 trials of 3 tests. After the first round of testing participants were randomly assigned to either the group participating in static stretching or the group participating in dynamic stretching. The 3 tests each participant underwent were sit and reach tests, Y balance tests, and the measuring of hip, quad, and hamstring angles. The sit and reach test was repeated 3 times per trial. The Y Balance test was done once every trial with each leg. The measurements of angles were repeated 2 times per trial. RESULTS: Data is ongoing. CONCLUSION: while data collection is ongoing, we are able to with our current study, which are the limits of time as well as If we had more time as well as more it would have us gain more in our could be that we have some who are in and some this could and the daily that the and could have an effect on the of our like ours allow more time to recruit more as well as allow more time so that there are from each woman's

sport.The 3 tests we used were very useful in our data collection and we would re use them in future testing.

44. Peter Coleman, Cody Cramer, Colin Renner

Reaction time Open vs Closed Skill

EXSC 3300 - Research Methods in Exercise Science Instructor: Lisa Stegall

Reaction time plays a big role in sports because it allows athletes to adapt to stimuli and make decisions that could affect their performance. We wanted to test the difference between open and closed skilled athletes to see if there was a difference in reaction between the two. Most research just focused on comparing different open-skilled sports rather than directly comparing open versus closed-skilled sports. PURPOSE: To compare reaction time between college athletes in football (open skill), gymnastics (closed skill), and a control group of non-athletes. METHODS: Eighteen participants (six football, six gymnastics, and six nonathletes) performed two tests of reaction time - the Human Benchmark test and the ruler drop test.. The participants were placed in front of a computer and were asked to look at a screen while it was red, then once it turned green, to click as fast as possible. This test was performed 3 times. The second test was a ruler drop test. The participants sat at the edge of the table resting their elbow on the table so that the wrist of their dominant hand extended over the side. We then dropped the ruler, and the participants had to catch the ruler as fast as possible. We then recorded the distance the ruler fell. We then convert the distance (cm) to time (ms). We measured these results with one-way ANOVA, and we used the average time from each test and group. RESULTS: No significant differences were found between any of the groups, although the benchmark test showed gymnastics (213.75ms±15.06ms) with a lower time and football (227.02ms±19.45ms) had a higher time. Non-athletes (215.32ms±18.88ms) were in between both groups (P=0.3951). In the ruler drop test, gymnastics (0.142ms±0.0231ms) had the lowest time, while football (0.145ms±0.0378ms) had a higher time, and non-athletes (0.155ms±0.0315ms) had the highest time (P=0.7501) CONCLUSION: Reaction time was not significantly different between the three groups, but this is likely due to our small sample sizes. Further research is required to show how other closed and open skill sports affect reaction time with more participants in each group.

45. Rachel Callery, Marissa Fehr, Jaime Hort

Hand Grip Fatiguing Study in NCAA D3 Athletes Who Use and Do Not Use Hand Held Equipment in Sport

EXSC 3300 - Research Methods in Exercise Science Instructor: Lisa Stegall

Hand grip strength test is considered a baseline measure for assessing the functionality of the hand and is vital in carrying, opening, lifting, and driving, and athletes competing in sports that may require strength in various muscle groups. PURPOSE: The purpose of this study is to determine if there are forearm and hand muscular differences in endurance between NCAA D3 student-athletes who compete with a racket or stick and athletes who do not, before and after the completion of a hand and forearm fatiguing protocol. METHODS: NCAA Division III athletes were recruited by an email sent to head coaches of teams at Hamline University which was then forwarded to the athletes on that team. The goal is 30 participants. An explanation of the study, the procedure, and possible side effects was given to the participants. They would then do a familiarization trial using the hand grip dynamometer. After one minute, the initial hand grip strength test was conducted, followed by a 10kg plate hold until failure. After dropping the plate, a 20-second rest period occurred before their final hand grip strength test. All tests were performed on the dominant hand. RESULTS: Data collection is ongoing. CONCLUSION: Although data collection is ongoing, some limitations within our study have been

identified. Initial hand placement on the farmer's carry plate hold is extremely important. Those who did not have a strong initial grip produced data that is not congruent with the overall trend thus far. Future studies could include athletes from various schools in NCAA Division III athletics to broaden the understanding of hand grip strength of different athletic needs as more data would allow for more precise results.

46. Maya Cruz, Lorna Heil, Milla Infante Puente

Impact of Music Genre on the Exercise Performance of DII Collegiate Athletes

EXSC 3300 - Research Methods in Exercise Science Instructor: Lisa Stegall

Previous research has demonstrated that auditory stimuli, specifically the tempo of music, is a core force in driving changes in exercise intensity and may enhance athletic performance. While it may be a common habit to listen to music prior to an athletic competition or during exercise to seek better results or motivation, it may also affect how the individual rates their perceived exertion. PURPOSE: This study aims to analyze the effects of musical genre on the exercise performance of Division III collegiate soccer players by investigating how this population responds and rates their perceived exertion while listening to different genres of music at different tempos while performing the Bruce treadmill protocol, offering us additional insight to the influence of auditory stimuli in exercise performance. METHODS: 6 participants (3 male and 3 female Hamline University soccer players) completed the Bruce treadmill protocol four times while listening to randomly selected genres of music (90's R&B, Jazz, and upbeat House music) including an initial no-music control trial. Heart rate and Rating of Perceived Exertion (RPE) was measured pre- and post exercise. Throughout the protocol these same measurements were recorded until HR reached 85% of age-predicted maximum. An analysis of the data is pending. RESULTS: Data collection is ongoing. CONCLUSION: While data collection is still ongoing, we are able to identify limitations to our study. These limitations include people rating their perceived exertion differently and external factors outside of our control, such as sleep and eating habits, mood, and energy levels due to potential strains from school, work, or stress.

47. Sundus Mohamoud, Cailey Price, Emma Witterstaetter

Hand grip strength levels in gymnasts compared to non-gymnasts

EXSC 3300 - Research Methods in Exercise Science Instructor: Lisa Stegall

Hand grip strength is used to measure voluntary muscular strength and is typically one of the most common indicators of overall strength. However, there is a lack of research examining how hand grip strength varies between gymnasts and other athletic or non-athletic populations, along with limited research on gymnasts in general. PURPOSE: The purpose of this study is to compare hand grip strength (HGS) in the dominant hand of female college students aged 18–23 across four groups: non-collegiate athletes, collegiate athletes who are not gymnasts, gymnasts who train on the uneven bars, and gymnasts who do not train on the uneven bars. METHODS: Participants completed a hand grip strength test using a hand dynamometer. Five participants were recruited for each group (through text, email, and verbal announcements), with an overall total of 20 female college students. Each participant performed a familiarization test followed by three trails, and results were recorded and analyzed to identify differences in HGS across groups. Statistical analysis will be conducted using one-way ANOVA. RESULTS: Data collection is still ongoing, so results are not finalized yet. CONCLUSION: While data collection is still ongoing, we are able to identify limitations with our current study, which are limited participants due to the short amount of time used to collect data, an unclear separation of the groups with a few of the participants, as well as soreness or other issues

causing participants to not reach their full HGS potential. Future studies should follow a similar protocol to ours, but with more participants.

48. Zachary Reinsma

Unpacking the Asylum Labyrinth: Navigating the US and UK Asylum Systems Through Professionals' Eyes

GIST 3980 - Special Topics Instructor: Letitia Basford

2024 is an election year for both the UK and the US. Immigration is a crucial issue for both countries. Of specific concern to voters are the asylum systems--who is allowed into the country legally and who will be denied entrance. This research investigates the perceptions of the professionals in each country who work with asylum seekers about the effectiveness of their current asylum systems and their ideas for improvements. Data was collected by interviewing three professionals from each country working directly with asylum seekers. Interviews from the US revealed issues of outdated asylum laws, poor access to work and legal representation, challenges around trauma, and negative policy and national perceptions perpetuated by political leaders. Interviews from the UK revealed frustrations around the underfunding of legal aid, the inability of immigrants to work and become self-sufficient, the lack of support for challenges with trauma, and negative national perceptions perpetuated by political leaders. The findings also produced several recommendations for policy improvements, such as more asylum officers and judges to move cases faster and an immediate ability to work after filing an asylum application. Given the lack of literature exploring the perceptions of the professionals working with asylum seekers, this research fills a much-needed gap.

49. Sherlyn Aca Valle, Quincy Asmus, Jamie Gallo, Stacey Martin, Mario Martinez Reyes

The Strangeways Prison Riot

HIST 1980/CJFS 1980 - Police, Prisons, and the Public: Histories Instructor: Susie Steinbach

Our presentation is about informing the audience about this specific prison riot that brought attention to poor prison conditions. We want to argue that better prison conditions are all around better for prisoner reform, as well as for prison guards' mental health and safety. At this point in time, toilets had been around for nearly 50 years, yet prisoners were forced to to use a chamber pot with 3 different people. They were not allowed to dump out the chamber pot until a certain amount of time which is just an example of the dehumanization going on prisoners lives while they were in Strangeways. We are hoping to reach the audience and having them understand the need of better prison conditions. Dehumanization does not equal rehabilitation.

50. Alexander Blilie, Emma Collins, Sinahi-Loyola Medina, Kendra Nordick, Jada Storm

Rodney King Riots

HIST 1980/CJFS 1980 - Police, Prisons, and the Public: Histories Instructor: Susie Steinbach

Our presentation will focus on the Rodney King riots of 1992, we will be looking into the racial disparities, social issues, and socio-economic issues during this time which might have the answer to why the beating happened and why the riots were so violent. We also want to use this incident in police history/U.S history to one raise awareness to the event but also use it as a teaching lesson so we can one grow as a nation but also a community. Overall there are a lot of takeaway from this event and we want to highlight important facts and key takeaways to illustrate our above points.

51. Nathalia Brinkman-Mercedes, Grace Hoffmann, Judah McKnight, Jackson Nelson, Bee Swan-Kloos

The interconnectedness of Police perception and the 1965 Watts uprising**

HIST 1980/CJFS 1980 - Police, Prisons, and the Public: Histories Instructor: Susie Steinbach

Our project is on the L.A. Watts uprising of 1965. We identify how the Watts uprising began, what happened during the event, and the aftereffects of it, emphasizing how all the groups involved saw each other: the uprisers, the police, the government, and the general public. We show how the relationship between the L.A. police and the Watts residents helped cause the uprising and the individual pushbacks that happened after. Pushback directed towards the L.A. police was from the Black community, while pushback towards the Black community themselves occurred at a local and national level, which created political resistance towards the Civil Rights movement. We also look at how the event was portrayed by the media to try and push a certain image of what was happening through newspapers and other news sources. Finally, we look at the lasting effects the uprising had on not only the L.A. police and law enforcement as a whole, but also the image that Watts has sustained all these years.

52. Jamya Cusic, Isabella Jensen, Conor Mestemacher, Samara Springer, Claire Vang

Detroit Riot of 1967

HIST 1980/CJFS 1980 - Police, Prisons, and the Public: Histories Instructor: Susie Steinbach

Our goal is to argue that racial injustices led to a lot of violence. We want to show how this has been an impact of the past, not just the present. We want to argue that this riot, and others like it at the time, challenged the way Americans perceived and depicted Black violence. The Detroit Riot of 1967 was one of the many riots that happened in America in the summer of 1967. Beginning on July 23rd 1967, this riot led to the deaths of 43 people, many of which were black Americans residing in the urban area of Detroit. The rioting also led to the arrests of around 7,000 people. All of this started because of a raid police made on a predominantly black neighborhood, which turned into looting, violence, and arson. This riot lasted 5 whole days and was deemed one of the deadliest riots during the 60s. The riots showcased what was happening within the United States, we were moving into 2 societies, one black, and one white. Separate and unequal.

53. Jordan Fulin, Soliha Narzullaeva, Saari Nure, Anthony Peasha, Mara Turner

Pipestone Indian Training School

HIST 1980/CJFS 1980 - Police, Prisons, and the Public: Histories Instructor: Susie Steinbach

We want to provide historical context on Pipestone Boarding School, including when it was active, its purpose, and how it operated. We want to show the emotional, cultural, and generational effects on Indigenous families and communities and to emphasize that these schools were created to erase Native cultures, languages, and identities through forced assimilation. Lastly we want to inspire people to think critically about the lasting effects of these schools and how they connect to ongoing struggles for Indigenous rights and cultural preservation.

54. Jacy Johnson Becker, Priya Nacy, Anja Otten, Evelyn Sweetman, Alexis Thoennes

The Attica Prison Riot: How Policy, Protest, and Public Opinion Shaped American Prisoner Rights

HIST 1980/CJFS 1980 - Police, Prisons, and the Public: Histories Instructor: Susie Steinbach

Our presentation examines the 1971 Attica prison riot, with special focus on the precursors that lead to the riot, as well as the consequences that came from it.

55. Stephanie Bluhm

How the lack of Civic Education in American K-12 Schools Contributes to the decline in Government and Political Efficacy

PSCI 5000 - Political Science Senior Seminar Instructor: Alina Oxendine

The topic of Government and Civic education in the United States is less talked about than it should be. Personally, I believe that basic political literacy should be taught from a young age. Not necessarily in a political manner, but instead in an almost mechanical way, teaching about what position or group of people does what action in the United States government. Understanding the basics of government should be taught much more in American schools. Children attending public schooling are due to a series of political acts and policies that many people do not realize. Students receiving education, and having books, materials, and technology available to them, can be taken for granted. These students will have the opportunity to cast a ballot one day; it should never be so difficult and confusing that they choose not to practice their civil due diligence, which is to vote. The inner workings of the United States government are fed to Americans in a way that they cannot digest. If we continue to make the information incomprehensible, we will struggle to understand political efficacy as a country. In a constantly changing world with rampant misinformation being spread, it is important to teach students and non-students about the workings of the United States government. Political efficacy in America is struggling (Soskil 2021). Many people feel like they have no say in politics whatsoever. Political efficacy can be defined as the understanding of each voice or vote making an impact or difference in politics or policies. If an individual casts a vote, as U.S. citizens, we should trust and believe that our vote will count and make a difference. Our vote is pertinent to democratic decision-making (Leece 2008). Understanding how each vote makes a difference is essential to confidence in political efficacy in America.

56. Evelyn Wiltrout

Evaluating Healthcare Disparities in Rural and Urban Counties through a Comprehensive Analysis of Pregnancy Related Health Outcomes

PSCI 5100 - Senior Practicum Instructor: Alina Oxendine

During this past semester, I had the opportunity to conduct my own research study. I am very passionate about healthcare accessibility, so I knew that was the direction I wanted to go. My methodology was a comprehensive analysis. I looked at a variety of health statistics related to pregnancy outcomes separated by county in Minnesota. The main emphasis of this research was to determine if there are disparities in outcomes based on rurality. While pregnancy isn't all consuming in terms of health accessibility, the specificity of it can provide insight to certain trends in our healthcare system, without trying to analyze all adverse health issues. I hypothesized that rural counties will have more adverse health outcomes and accessibility issues surrounding pregnancy, which will be exemplified through a variety of health outcomes. Additionally, I controlled for varying factors like socioeconomic status and education to determine their influence, and considered the role that social determinants have in healthcare accessibility and adequacy. Ultimately, my conclusions are leading towards, yes there is a disparity in access to care based on where you live. The next goal would be to determine where we can intervene at a public policy level to correct this.

57.Isabelle Bradshaw, Iain Lee, Montana Miller, Morgan Mitsch, Eli White

A Review of Evidence-Based Psychological Interventions for Video Gaming and Internet Use Disorders

PSY 3010 - Independent study Instructor: Serena King

The purpose of this review is to examine the effectiveness literature on treatment for internet use disorder (IUD) and gaming disorder (GD). We conducted a search using Google Scholar and APA Psycinfo for therapeutic interventions including Cognitive Behavioral Therapy (CBT), behavior therapy, mindfulness-based therapy (MBT) Acceptance and Commitment Therapy (ACT), and other forms of multimodal treatment. We identified 23 articles related to the treatment of these disorders. Our findings suggest several modalities of treatment including CBT and MBT are effective treatments for Internet Use Disorder and Gaming Disorder. Through our research we have found the most evidence for CBT and MBT, with multiple sources claiming that they are the most effective forms of treatment for IUD and GD, especially when they are used alongside each other during treatment. With this review we set out to inform people on the current treatment for these disorders and what is currently working. We hope to help further lead the treatment for these disorders in the right direction.

58. Iris/Sam Eichinger

Personal Religion and Personalized Medicine in Aelius Aristides' Sacred Tales

REL 3970 - Independent study: Personal Religion in Ancient Greece Instructor: Trevor Maine

Aelius Aristides was a Greek writer during the Roman Imperial era who, among other writing, wrote a years long journal of his experiences seeking healing at a temple of Asklepios, one of the Greek gods of healing. These journals describe his dreams, where he is often visited by various gods, with whom Aristides develops personal relationships. This poster will discuss the evidence for personal religion, a new framework for religious experiences in ancient Greece, in Aelius Aristides' Sacred Tales through those relationships. Personal religion focuses on individual and lived experiences, as opposed to previous frames like 'polis religion' which focuses on communal and political practices. Aristides' Sacred Tales proves that developing personal relationships (and personal healthcare plans) was important to Asklepian healing rituals and Greek religion as a whole.

59. Addy Ehler, Abbie Chandarath, Lindsay Eckelman, Makenzie Johnson, Sarah Kirk, Stephanie Vela Alonso

Student AI use in Schoolwork

SJSC 3920/CJFS 3140 - Social Research Methods Instructor: Becca Chalit Hernandez

The goal of this research is to determine how students use AI tools for schoolwork, and what behavioral patterns are associated with their usage. By understanding how students incorporate AI into school, such as using it on tests or assignments, we can determine just how much and why students use AI in their everyday school lives. This study relies on self-reported data from Hamline students about their AI usage patterns.

60. Julia Klinker

Social Media Usage & Mental Well-being Perceptions

SJSC 3920/CJFS 3140 - Social Research Methods Instructor: Becca Chalit Hernandez

Our research examined how social media usage impacts mental well-being perceptions in Hamline students. We examined respondents' average time they spend on social media per week, the respondent's most frequently used social media site, and how respondents engage with social media (creating content, engaging with content by commenting/reposting, or passively scrolling) to analyze how these different factors associated with social media usage impact mental well-being perceptions. Our survey assessed several aspects of mental well-being perceptions, such as how important one considers mental well-being awareness to be and how one engages with mental well-being content.

The wide range of mental well-being perceptions we assessed allowed us to examine how social media usage impacts both an overall perception of mental well-being and specific aspects of mental well-being perceptions. Finally, we gathered basic demographic information to analyze how individuals' student status (undergraduate versus graduate and full-time versus part-time), commuter status, age, gender, and participation in activities at Hamline may correlate with patterns in social media usage or mental well-being perceptions.

61. Rosie Knowlton

Accountability in Healthcare Literacy

ENCM 5900-1 - Senior Seminar Instructor: Suda Ishida

Healthcare literacy is a critical skill for every individual. However, not everyone has access to scientific journals with research publications containing the information they need. Either because there is some sort of paywall or technological barrier, or because the information is written in specific medical jargon that a layperson would not understand. Turning to outside sources that "simplify" the information often leads to significant mistakes, oversimplification, and/or misinformation. That information is then used by laypersons to make decisions about their health that may not be founded in accurate information, likely leading to physical, mental, and financial consequences as they navigate the healthcare system. Information being published from healthcare research is critical for everyone to access, but it is inaccessible without a substantial amount of prior knowledge of the field, which is not feasible to expect from everybody. Therefore, there needs to be a bridge between the two. Through interviews with representatives and assessments of healthcare publication journals and research publication offices, this paper will discuss if there is an acknowledgment of this gap, and what if anything is being done to work towards closing it. It will also provide perspectives from non-healthcare professionals about their experiences with healthcare information access.

62. Lucas LiaBraaten, Diego Luna-Gutierrez, Shelby Phillips

Economic Method for Chloride Filtration via Capacitive Deionization

PHYS 5920 Research-Project Base Advanced Lab Instructor: Lifeng Dong

Our research focuses on developing a cost effective and sustainable method to remove chlorides from water sources using capacitive deionization. By using electrodes formed with a bismuth carbon composite, we aim to enhance chloride ion filtration while maintaining environmental sustainability. Our project addresses the increasing issue of chloride pollution due to road deicing and water treatment processes, ensuring cleaner water for the environment, and as a drinking water source. We will be able to determine if we are successful in our goal by viewing our bismuth carbon composite electrodes with a scanning electron microscope. We can also determine the power consumption of our filter to determine the efficiency.

63. Robert Morrison, Anders Anthonisen-Brown, Thomas Evans

Homemade Potentiostat

PHYS 5920 Research-Project Base Advanced Lab Instructor: Lifeng Dong

Lead contaminated drinking water poses a serious health concern for many Americans. Typical lead detection methods are expensive, meaning rural and disadvantaged communities experience difficulty in testing the safety of drinking water. A potential alternative which is more accessible and reliable is to use a homemade potentiostat for anodic stripping voltammetry to readily detect heavy metals in the community. The open source potentiostat, "PassStat", was developed to be an affordable teaching tool for electrochemical applications and can be created for under $100 using basic resistors, capacitors,

operational amplifiers, and cheap microcontroller. The PassStat has potential to be applied to heavy metal detection in water, which provides opportunity for a cheap and accessible potentiostat device to be used in these disadvantaged communities. We attempt to update the PassStat from the Teensy board 3.X series to the 4.X series before attempting to compare it to commercially available potentiostats when used for heavy metal detection.

64. Nevaeh Barnd, Kaitlyn Morgan, Aoi Suzuki

The Effect of a Short Cycling Exercise Bout on Athlete's Cognitive Performance

EXSC 3300 - Research Methods in Exercise Science Instructor: Lisa Stegall

Physical Activity has been shown to benefit adolescents and adults regarding their cognition and brain development. Numerous studies in adolescents and some young adult age groups have found correlations; however, many of the studies on athletes were compared to non-athletes or to other athletic sports.

65. Abdi Hallo, Matthew Maroney, Alexander Rebman, Daniela Sanchez-Castillo

The Effects of Document Readability on Consumer Understanding of Credit Card Disclosures

ECON 3750-1 Behavioral and Experimental Economics Instructor: Ryan McWay

Consumer understanding of disclosures is an important factor in economic equity and functioning of the economy. Controversy has arisen in economic literature in recent years with regard to the efficacy of standard measures of document readability, such as the Gunning-Fog Index. We test the effectiveness of the Gunning-Fog Index at predicting document readability as measured by consumer understanding of the details contained in a credit card disclosure. We present consumers with one of two credit card disclosures, each with substantially different Gunning-Fog Index scores, and test for statistically significant differences in consumer understanding of the document.

Student Recital

Tuesday, May 6, 2025

11:30-12:30 Sundin Music Hall

Anton Melnichenko, piano accompanist

Deh vieni, non tardar from Le Nozze di Figaro — Wolfgang Amadeus Mozart

Sidney Lavelle, voice

Voi che sapete from Le Nozze di Figaro — Wolfgang Amadeus Mozart

Izzy Mayaka, voice

In Old Vienna — William Gillock

Fountains in the Rain — William Gillock

Ivan Souzek, piano

Ich wandelte unter den Bäumen — Fanny Hensel

Bella Deschene, voice

Der Mond — Felix Mendelssohn

Angel Martinez, voice

Rustle of Spring — Christian SInding

Justine Morris, piano

Dust in the Wind — Kerry Livgren (Kansas)

Jonathan Bayer, guitar

Christopher Becknell, accompanying guitar

Amarilli, mia bella — Giulio Caccini

Ifee Ngwu, voice

In der Fremde — Robert Schumann

Alex Bailey, voice

Divertimento for Violin and Viola — Adolphus Hailstork

I. *Brioso*

Antara Bhattacharyay, violin

Emery Thul, viola

Non piu andrai from Le Nozze di Figaro — Wolfgang Amadeus Mozart

Emmett Frett, voice

All I Ask of You from Phantom of the Opera — Andrew Lloyd Weber and Charles Hart

Bri Cook and Emmet Frett, voice