

7th ANNUAL

MONTANA STATE UNIVERSITY BILLINGS

**RESEARCH, CREATIVITY, AND  
COMMUNITY INVOLVEMENT CONFERENCE**

SPRING 2020



montana state university

**BILLINGS**

# 2020 Virtual Conference

Due to COVID-19 restrictions, Montana State University Billings will hold its seventh annual Research, Creativity & Community Involvement Conference (RCCIC) in an online format. Sponsored by the Office of Grants and Sponsored Programs, the University Honors Program, and Montana IDeA Networks of Biomedical Research (INBRE), the conference provides a great opportunity for undergraduate and graduate students of all majors to present their research and creative scholarship in a public forum.

This year's conference was divided into three groups:

- **Presenters:** Students who submitted abstracts to the RCCIC, and who were able to complete their projects and have their presentations posted to ScholarWorks.
- **Abstracts:** Given the circumstances of the current pandemic, some students were not able to complete their projects, and so were not submitted to ScholarWorks for publication. However, we chose to include their abstracts in the program, as those abstracts were still approved for conference participation by the Research Committee.
- **NCUR Students:** These students were chosen to present their scholarly work at the 2020 National Conference on Undergraduate Education in Bozeman, MT, in March. As this Conference was also cancelled, we wanted to still acknowledge the achievement of these students by including them in our program as well.

## **THANK YOU** **TO ALL FACULTY WITH STUDENT PARTICIPANTS**

Dr. Rebecca Berru Davis  
Dr. Samuel Boerboom  
Dr. David Butler  
Dr. Jason Comer  
Dr. Rhonda Dillman  
Dr. Lynn George  
Ms. Tami Haaland  
Dr. Michael Havens

Dr. Tom Lewis  
Dr. Matt McMullen  
Dr. Virginia Mermel  
Dr. Paul Nash  
Dr. Tom Nurmi  
Dr. Matt Queen  
Dr. Alex Shafer  
Dr. Cheryl Young-Pelton

# PRESENTATIONS

## Studying and Teaching the Ethical Dilemma of Emily Dickinson

*Student Researcher: Brienna Barron*

*Faculty Mentor: Dr. Thomas Nurmi*

*Degree: B.A. English*

This essay focuses on the ethical dilemma of studying and teaching the work of American poet Emily Dickinson. Because her work was found and published after her death, studying Dickinson's works can be viewed as an intrusion of privacy. This essay examines Dickinson's Envelope Poems—lyrics written on envelopes, wrappers, and loose scraps of paper—to see how Dickinson herself worked through many of the ethical issues that confront readers today. This essay also explores questions about power structures in our society, specifically within academia. Research for this essay consisted of close reading many of Dickinson's poems, including her envelope poems and fascicles, and extensive discussion of the lyrics and the ethical questions the work raises. Due to the nature of the subject of this essay, the research process provoked ethical questions of its own. The aim of this essay is to make clear the importance of teaching Emily Dickinson's work alongside her biography, and the importance of reading her work with the intention of studying the ethical dilemma that her work generates.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15944>

---

## Comparing Influenza vaccination rates before and after the H1N1 pandemic

*Student Researcher: Connor Brandon*

*Faculty Mentor: Dr. Matthew McMullen*

*Degree Program: M.S. Psychology*

Immunizations are an important public health concern in order to help control the spread of diseases. Influenza is a particularly important seasonal vaccine, as it is updated every year and recommended that all people receive the vaccination. Unfortunately, not everyone receives the vaccine, which can make others more susceptible to contracting the disease and spreading it to others. Using data from the Center for Disease Control's (CDC) National Immunization Survey (NIS), the number of child and teenage influenza vaccinations were compared before and after the H1N1 (Swine Flu) pandemic of 2009. It was hypothesized that the H1N1 outbreak would lead to an increased rate of vaccinations in both children and teenagers. The data was grouped by geographic region and socioeconomic status. The comparative results show that there was not an increased number of childhood or teenage vaccinations relative to the total amount of influenza vaccinations that were administered, indicating that the H1N1 pandemic did not cause a greater number of influenza vaccinations in the following years.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15945>

# Walking Does Not Significantly Improve Word Recall or State Anxiety in a Single Session: A Pilot Study

*Student Researcher: Connor Brandon*

*Faculty Mentor: Dr. Michael Havens*

*Degree Program: M.S. Psychology*

Research suggests that exercise can improve memory ability (Labban & Etnier, 2011; Martins et al., 2013; Shih, 2017; Standage, 2010) and decrease anxiety (Blacklock et al., 2010; Knapens et al., 2009). The current study hypothesized that an exercise condition will recall more vocabulary words and have greater reductions in state anxiety compared to the sedentary control condition. Participants were randomly divided into either a sedentary control group or an exercise group. Both groups took the State-Trait Anxiety Inventory questionnaire (STAI-AD). Both groups were then given ten minutes to learn 15 vocabulary words while either sitting in a chair or walking on a treadmill at 3mph, followed by a 20-minute consolidation period. Participants were asked to recall as many words as they could remember from their task and took the STAI-AD a second time. Paired t-tests were performed for analyzing the reduction in state anxiety and amount of words recalled in both conditions. The pilot results showed the exercise group (n=4) did not remember more vocabulary words compared to the control group (n=2;  $t = 0.4078$ ,  $p\text{-value} = 0.749$ ). The exercise group did show greater reductions in state anxiety compared to the control group ( $t = 1.1847$ ,  $p\text{-value} = 0.4298$ ). However, both analyses returned statistically insignificant results due to small sample sizes. Further data will be collected to obtain statistical significance and retest the hypothesis.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15946>

---

# Can a Conventional Deadlift Exercise Reduce Low Back Pain in Physical Therapy Patients?

*Student Researcher: Alyssa Cole*

*Faculty Mentor: Alex Shafer*

*Degree: B.S. Health and Human Performance*

Low back pain is a common health condition affecting 50-80% of American adults. Traditional rehabilitation of the low back includes hip mobility/flexibility and core strengthening/stabilizing exercises. A conventional deadlift executed with proper form, promotes a neutral spine, core stabilization and hip mobility. **PURPOSE:** To determine the effect of performing a conventional deadlift routine on low back pain. It is hypothesized that the conventional deadlift will provide similar effects as the traditional low back rehabilitation program by reducing pain and improving function. **METHODS:** Forty participants seeking treatment for lower back pain at an outpatient Physical Therapy (PT) clinic will be recruited to participate in the study. Potential participants will be screened for inclusion/exclusion criteria prior to participation. Half of those who agree to participate will be assigned to the experimental group and receive the additional deadlift exercise routine incorporated into the standard PT administered therapy sessions. The other participants will be assigned to the control group (PT without additional deadlifting). Each participant will complete the Oswestry Disability Index (ODI) during the initial visit, mid-point of treatment, and then again at the end of the intervention. The PT staff at the clinic have volunteered to

administer the ODI assessment as well as the deadlifting intervention on behalf of the student researcher. **EXPECTED RESULTS:** Participant characteristics of age, sex, and injury history will be reported. ODI scores and length of treatment will be compared between groups using independent t tests. The results of this study can help to determine whether the benefits of strengthening of the core, hips and back musculature from the deadlift exercise improves patient outcomes beyond a standard low back rehabilitation program. Improving physical therapy treatment options for individuals with low back pain is a critical step in help individuals manage low back related pain and disability.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15947>

---

## **Food Insecurity: Hunger among Senior Citizens in Our Community**

*Student Researcher: Alyssa Dawes*

*Faculty Mentor: Dr. Virginia Mermel*

*Degree Program: B.S. Psychology*

Building on the work of previous HONR 499 courses, which researched food security in Yellowstone County and suggested and carried out possible solutions, this class conducted a student food insecurity survey and proposed several steps to address this problem. After reviewing community-wide gaps in food security, the Spring 2020 class chose to focus on food insecurity among YSC senior citizens. After a decade of decline, hunger is a growing problem in specific sectors of America due to the increasing income gap between service sector workers and skilled laborers, higher birthrates among the lowest compared to the highest income groups, and an increasing proportion of the population age 55 and above. Through a combination of literature searches and interviews with Stacy Brown, Executive Director of Family Service the local Feeding America Partner and designated provider of the federal Senior Commodity Food Box Program, the students identified the risk factors for-- and consequences of-- senior food insecurity at the county and state levels. The students developed a multipronged approach to reducing the 12% incidence of food insecurity amongst YSC seniors. The plan featured: 1) a publicity campaign, including a press conference for selected stakeholders, to increase community awareness of the issue of senior food insecurity and simultaneously kick-off a food drive; 2) targeted poster advertisements for volunteers and infographics; 3) creation of a joint Rocky Mountain College /MSU, Billings student volunteer program to produce the 700-plus monthly Senior Commodity Food Boxes; 4) a food-box creation test run; and 5) ongoing donations from Walmart, a local Feeding America corporate partner, of highly desirable foods like nut butters and extra canned fruits, which are often in short supply, and easy, affordable recipes featuring foods commonly included in the Senior Commodity Food Boxes. The Covid-19 pandemic derailed implementation of these plans. These plans are ready to be implemented by a future class, pending any modifications suggested by food security lessons learned during the Covid-19 crisis.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15951>

---

## Who Reads More?: Comparing Book Consumption Rates Between Various Groups

*Student Researcher: Andrew Donnelly*

*Faculty Mentor: Dr. Matthew McMullen*

*Degree Program: M.S. Psychology*

In the Pew Research Center (2019) Core Trends Survey for Internet & Tech, one item asked respondents how many books they consumed during the past 12 months. Based on this data, the present research addresses five questions. How are sex and average number of books consumed related? How are generational cohort (Millennials, Generation X, and Boomers) and average number of books consumed related? How are educational attainment and average number of books consumed related? How are income and average number of books consumed related? How are political party affiliation and average number of books consumed related? Analysis (focused on graphics) shows differences across each of the five sets of comparisons.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15928>

---

## Successful Growth of RIL *Arabidopsis thaliana* Offspring Based on Traits Shared with Parent Plants

*Student Researcher: Cailen Herriford*

*Faculty Mentor: Dr. Jason Comer*

*Degree Program: B.S. Biology*

This study was primarily focused on phenotypic observation of *Arabidopsis thaliana* offspring from the parent cross of varieties Columbia (CS933) and Landsberg (CS20). *Arabidopsis* was an ideal organism to use in this study due to its array of distinctive heritable traits and its relatively short life cycle. The offspring used in this study were recombinant inbred lines (RILs), which have been allowed to self-pollinate over a series of generations in order to fix their homozygosity. The RIL offspring of the two *Arabidopsis thaliana* parent varieties should exhibit a combination of observable traits from both parents. Given that Columbia grows in a warmer region, at a temperature closer to the conditions found in the growth room, it was hypothesized that these parent plants would grow more successfully than the Landsberg parent plants. By this same logic, it was hypothesized that offspring which share more traits with the Columbia parent would be more successful than those offspring which share many traits with Landsberg. The traits that were measured to determine growth success include silique number per plant and number of branch points off the main inflorescence (to determine fecundity), as well as the inflorescence height at the end of the growth period. Ultimately the CS20 parents were found to be less successful at surviving under the given conditions, as they showed the lowest averages in all the categories measured. The majority of the offspring shared two of the most distinctive phenotypic traits with CS933, floppy inflorescence and pointy siliques, while only one offspring line shared the blunt siliques and erect inflorescence found in CS20. Additionally, the most successful offspring lines tended to also be those plants with the largest rosette diameters, which was confirmed to be predictive of success by a linear regression analysis.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15948>

## Trend of Internet Searches Related to “Coronavirus”

*Student Researcher: Emily Hughes*

*Faculty Mentor: Dr. Matt McMullen*

*Degree Program: B.S. Psychology*

Very evidently, the coronavirus has become a worldwide issue that has sparked panic across many nations. This project examines how Google searches related to coronavirus have spiked and fallen within the last few months since the beginning of the pandemic. Using RStudio - a coding platform - and the specific function “trendy,” the trend of searches will be shown in graphs, as well as tables. The results show that the searches spike around January and February, and that places such as Italy showed a larger peak in searches for the disease compared to the United States.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15949>

---

## Food Insecurity: Hunger Among Senior Citizens in Our Community

*Student Researcher: Taylor Kurkoski*

*Faculty Mentor: Dr. Virginia Mermel*

*Degree Program: B.S. Health Administration*

Building on the work of previous HONR 499 courses, which researched food security in Yellowstone County and suggested and carried out possible solutions, this class conducted a student food insecurity survey and proposed several steps to address this problem. After reviewing community-wide gaps in food security, the Spring 2020 class chose to focus on food insecurity among YSC senior citizens. After a decade of decline, hunger is a growing problem in specific sectors of America due to the increasing income gap between service sector workers and skilled laborers, higher birthrates among the lowest compared to the highest income groups, and an increasing proportion of the population age 55 and above. Through a combination of literature searches and interviews with Stacy Brown, Executive Director of Family Service the local Feeding America Partner and designated provider of the federal Senior Commodity Food Box Program, the students identified the risk factors for-- and consequences of-- senior food insecurity at the county and state levels. The students developed a multipronged approach to reducing the 12% incidence of food insecurity amongst YSC seniors. The plan featured: 1) a publicity campaign, including a press conference for selected stakeholders, to increase community awareness of the issue of senior food insecurity and simultaneously kick-off a food drive; 2) targeted poster advertisements for volunteers and infographics; 3) creation of a joint Rocky Mountain College /MSU, Billings student volunteer program to produce the 700-plus monthly Senior Commodity Food Boxes; 4) a food-box creation test run; and 5) ongoing donations from Walmart, a local Feeding America corporate partner, of highly desirable foods like nut butters and extra canned fruits, which are often in short supply, and easy, affordable recipes featuring foods commonly included in the Senior Commodity Food Boxes. The Covid-19 pandemic derailed implementation of these plans. These plans are ready to be implemented by a future class, pending any modifications suggested by food security lessons learned during the Covid-19 crisis.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15951>

---

## State Death Penalty Analysis

*Student Researcher: Katherine Loy*

*Faculty Mentor: Dr. Matthew McMullen*

*Degree Program: B.S. Psychology*

The United States has used capital punishment since colonization. Over time some states have abolished it and others have not. There are many databases that have collected information on each state's policy for the death penalty. Using these databases, I will take a deeper look at the death penalty in the United States as it varies from state to state. I will be using a few different death penalty databases, such as The Death Penalty Information Center, The Condemned and End of its Rope. After I gather data, using RStudio Cloud, I will analyze the data and generate statistics, graphs, and maps. The main areas I would like to look at are: which states still impose the death penalty, when did the other states abolish the death penalty, and what are the different methods of execution that different states use and how has that changed over time.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15859>

---

## Police Stops Analysis within Montana 2009-2016

*Student Researcher: Jeannine Mazel*

*Faculty Mentor: Dr. Matthew McMullen*

*Degree Program: B.A. Media Studies, B.S. Psychology*

The purpose of this analysis was to uncover multiple correlations in Montana police stops occurring between the years 2009-2016. Data on the Montana police stops was obtained from The Stanford Policing Project. The program Rstudio was utilized in order to calculate and reveal information and correlations surrounding the following:

- Most common race/gender/age group to be stopped.
- Most common reasons for police stops.
- Correlations between police stops and racial features.
- Geographical information and correlations for police stops across Montana roads, particularly for negligent homicide and DUIs.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15950>

---

# Food Insecurity: Hunger among Senior Citizens in Our Community

*Student Researcher: Kimber Mook*

*Faculty Mentor: Dr. Virginia Mermel*

*Degree Program: B.S. Elementary Education*

Building on the work of previous HONR 499 courses, which researched food security in Yellowstone County and suggested and carried out possible solutions, this class conducted a student food insecurity survey and proposed several steps to address this problem. After reviewing community-wide gaps in food security, the Spring 2020 class chose to focus on food insecurity among YSC senior citizens. After a decade of decline, hunger is a growing problem in specific sectors of America due to the increasing income gap between service sector workers and skilled laborers, higher birthrates among the lowest compared to the highest income groups, and an increasing proportion of the population age 55 and above. Through a combination of literature searches and interviews with Stacy Brown, Executive Director of Family Service the local Feeding America Partner and designated provider of the federal Senior Commodity Food Box Program, the students identified the risk factors for-- and consequences of-- senior food insecurity at the county and state levels. The students developed a multipronged approach to reducing the 12% incidence of food insecurity amongst YSC seniors. The plan featured: 1) a publicity campaign, including a press conference for selected stakeholders, to increase community awareness of the issue of senior food insecurity and simultaneously kick-off a food drive; 2) targeted poster advertisements for volunteers and infographics; 3) creation of a joint Rocky Mountain College /MSU, Billings student volunteer program to produce the 700-plus monthly Senior Commodity Food Boxes; 4) a food-box creation test run; and 5) ongoing donations from Walmart, a local Feeding America corporate partner, of highly desirable foods like nut butters and extra canned fruits, which are often in short supply, and easy, affordable recipes featuring foods commonly included in the Senior Commodity Food Boxes. The Covid-19 pandemic derailed implementation of these plans. These plans are ready to be implemented by a future class, pending any modifications suggested by food security lessons learned during the Covid-19 crisis.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15951>

---

## An Exploration into Social Media Sentiment

*Student Researcher: Ashley Pratt*

*Faculty Mentor: Dr. Matthew McMullen*

*Degree Program: M.S. Psychology*

**Background:** International and United States-specific media outlets cover the same news, but do not always utilize the same language. The COVID-19 Outbreak is an opportunity to analyze the sentiments being utilized to convey information to the masses. Exploring the words used and in what context can lead to more in-depth knowledge of what is being covered and how it is being explained by the media.

**Aim:** The goal of this project is to analyze tweets from ten major news organizations, both local and abroad, by sentiment. News organizations will then be assessed for their portrayal of the pandemic in a positive or negative light, what sentiments they are using and the frequency, and what words are being commonly written together. This project will also be able to assess the discrepancies between US coverage and that of the world. **Approach:** Data will be processed through Rstudio, utilizing sentiment

data found in the NRC Emotion Lexicon and Bing Sentiments. The results will be correlated and graphed to show the variance between news coverage and language in the United States versus coverage during the same time abroad. Custom bigrams will also be created to explore more specific word connections, i.e., “COVID,” “corona,” “pandemic,” etc., nationally and internationally. **Results:** Tweets will be divided into data frames and then analyzed by word by both sentiment programs. Results for each news organization will be appropriately represented. Additionally, bigrams will be run on any words of significance. Results of the analyzed data and any statistical significance will be released. **Conclusion:** From the results, conclusions will be drawn regarding the sentiments nation and international news outlets utilize day-to-day.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15952>

---

## **Food Insecurity: Hunger among Senior Citizens in Our Community**

*Student Researcher: Sari Robertus*

*Faculty Mentor: Dr. Virginia Mermel*

*Degree Program: B.S. Psychology*

Building on the work of previous HONR 499 courses, which researched food security in Yellowstone County and suggested and carried out possible solutions, this class conducted a student food insecurity survey and proposed several steps to address this problem. After reviewing community-wide gaps in food security, the Spring 2020 class chose to focus on food insecurity among YSC senior citizens. After a decade of decline, hunger is a growing problem in specific sectors of America due to the increasing income gap between service sector workers and skilled laborers, higher birthrates among the lowest compared to the highest income groups, and an increasing proportion of the population age 55 and above. Through a combination of literature searches and interviews with Stacy Brown, Executive Director of Family Service the local Feeding America Partner and designated provider of the federal Senior Commodity Food Box Program, the students identified the risk factors for-- and consequences of-- senior food insecurity at the county and state levels. The students developed a multipronged approach to reducing the 12% incidence of food insecurity amongst YSC seniors. The plan featured: 1) a publicity campaign, including a press conference for selected stakeholders, to increase community awareness of the issue of senior food insecurity and simultaneously kick-off a food drive; 2) targeted poster advertisements for volunteers and infographics; 3) creation of a joint Rocky Mountain College /MSU, Billings student volunteer program to produce the 700-plus monthly Senior Commodity Food Boxes; 4) a food-box creation test run; and 5) ongoing donations from Walmart, a local Feeding America corporate partner, of highly desirable foods like nut butters and extra canned fruits, which are often in short supply, and easy, affordable recipes featuring foods commonly included in the Senior Commodity Food Boxes. The Covid-19 pandemic derailed implementation of these plans. These plans are ready to be implemented by a future class, pending any modifications suggested by food security lessons learned during the Covid-19 crisis.

**ScholarWorks URI:** <https://scholarworks.montana.edu/xmlui/handle/1/15951>

---

# ABSTRACTS

## Infection Rate of Coronavirus and Its Internet Meme

*Student Researcher: Lucas Hert*

*Faculty Mentor: Dr. Matt McMullen*

*Degree Program: M.S. Psychology*

**Background:** Researchers, journalists, and media outlets have capitalized upon the recent coronavirus outbreak. A majority of the articles, video segments, and headlines occupying internet news feeds cover the topic and are often sensational and politically polarized. It certainly makes one wonder, what has spread faster? The virus, or the meme? **Aim:** I will attempt to assess whether the meme (shared idea, theme, or trend) has spread at the same rate as the virus. I hypothesize that the meme has outpaced the virus, and that its spread represents another mechanism through which viral agents infect--through the medium of the internet. **Approach:** I will gather datasets from online resources that have kept up-to-date figures on the total amount of confirmed coronavirus cases in the United States. This data will be compared and contrasted with Google trends data using an interactive mapping format to emphasize proportional comparisons. I will also gather time series data in order to analyze meme/virus spread temporally. **Results:** My project will present an analysis of the spread of the coronavirus against the spread of the associated internet meme. The results will be presented in the form of an interactive map which will display total coronavirus case numbers and total Google search figures by state. I will also include time series visualizations that show the same data within a temporal context. **Conclusion:** I will draw conclusions based upon the prevalence of both the coronavirus and its resultant internet meme. I hope that my conclusions shed light on the proposed manifold nature in which pandemic diseases spread - biologically, culturally, and digitally.

---

## Increasing Awareness of On- and Off-Task Behavior in a Child with ADHD and ASD through the Use of Self-Monitoring Strategies with a MotivAider<sup>®</sup>

*Student Researcher: Fabiola Jimenez*

*Faculty Mentor: Dr. Cheryl Young-Pelton*

*Degree Program: M.S. Special Education Advanced Studies w/ABA emphasis*

This thesis represents an experimental analysis procedure designed and carried out by this author to increase attention to and completion of math homework. The subject of this study was 13-year-old boy with Autism and ADHD. The skill was being able to self-monitor and increase his on-task behavior. In the intervention, a MotivAider (2 3/8" x 2 1/2"), an assistive technology device that vibrates at varying intervals, was used as a cue to increase his on-task behavior. Results showed some increase in his on-task behavior. Stronger results might have occurred with additional sessions. Previous research has shown that the MotivAider and self-monitoring is successful in increasing on-task behavior. Future research will look into techniques to increase motivation and accuracy of self-monitoring.

## **Do outbreaks actually have an impact on presidential elections?**

*Student Researcher: Chad Randall*

*Faculty Mentor: Dr. Matthew McMullen*

*Degree Program: B.S. Liberal Studies*

Politicians have always used various means to try and gain traction during election cycles. With the outbreak of the Coronavirus, a new conspiracy theory has arisen stating that every election cycle there has been some form of viral outbreak that has been used to try and garner leverage to impact the election. My intention is to use Google searches to see if there is a trend in viral searches and interest to determine if there is a trend in interest of outbreaks to election results.

---

## **Breastfeeding Text Analysis**

*Student Researcher: Breanna Riesen*

*Faculty Mentor: Dr. Matthew McMullen*

*Degree Program: B.S. Psychology*

This project conducted a text analysis of positive and/or negative language related to breastfeeding in Twitter tweets. The project included sentiment analysis, which is the analysis of text for the opinions or emotions it contains, as well as bigrams, which look for the most common words that follow two words (for this analysis, “breastfeeding” and “benefits”). Results are shown using word clouds, bigrams, and graphs.

---

## **Religious Survey Analysis**

*Student Researcher: Jayme Seeley*

*Faculty Mentor: Dr. Matthew McMullen*

*Degree Program: M.S. Psychology*

Generation Y has been described as the “faithless generation” in recent years. The purpose of this survey is to see if Generation Y is truly the least religious generation when compared with the previous generation, Generation X, and the even younger generation, Generation Z. Data were collected from participants in all three generations, including participants’ current religious views and practices, as well as their childhood views and practices. Other factors include marital status and if the participant has children. Religious organizations have often targeted married couples and families when perusing outreach opportunities. This study will show data that adheres to that concept- those who are married or who have children are more likely to actively practice religion.

# National Council on Undergraduate Research 2020 Accepted Abstracts

## Acute Effects of Antagonistic Stretching on Muscle Activation and Performance in Latissimus Pulldown

*Student Researcher: Ethan Albrecht*

*Faculty Mentor: Dr. Alex Shafer*

*Department: Health and Human Performance*

**Introduction:** Adequate levels of strength and flexibility are among the pillars of optimal health and wellness. Constant use of technology and occupational habits predispose people for increased risk for kyphotic posture. Stretching and strength training to mitigate and reverse the effects of poor posture may be optimized efficiently and effectively by incorporating inter-set stretching within a resistance training routine. **Purpose:** The purpose of this study is to determine the effects of stretching the pectoralis minor in between sets of latissimus pulldown exercises on subsequent electromyography (EMG) of prime movers and the amount of reps achieved. **Methods:** Twelve subjects performed two different strength training routines on two nonconsecutive days. The control trial included a latissimus pulldown for three sets of 10 repetitions with a two-minute rest period in between sets. The experimental group completed the same routine with the addition of a pectoralis minor stretching in between sets. **Results:** A one-way ANOVA test revealed a statistically significant difference in volume (sets x reps x weight) performed between the control ( $2951.25 \pm 484.7$ ) and stretching ( $3116.25 \pm 425.5$ ) conditions ( $p=0.007$ ). A one-way ANOVA test also revealed a statistically significant difference in surface EMG activity throughout the sets performed with  $p=0.013$  for no stretch group and  $p=0.005$  for the stretch group. **Conclusions:** The study revealed that inter-set antagonist pectoralis minor stretching may result in an increase in overall volume performed in the latissimus pulldown.

---

## Studying and Teaching the Ethical Dilemma of Emily Dickinson

*Student Researcher: Brie Barron*

*Faculty Mentor: Dr. Thomas Nurmi*

*Department: English, Philosophy & Modern Languages*

This essay focuses on the ethical dilemma of studying and teaching the work of American poet Emily Dickinson. Because her work was found and published after her death, studying Dickinson's works can be viewed as an intrusion of privacy. This essay examines Dickinson's Envelope Poems—lyrics written on envelopes, wrappers, and loose scraps of paper—to see how Dickinson herself worked through many of the

ethical issues that confront readers today. This essay also explores questions about power structures in our society, specifically within academia. Research for this essay consisted of close reading many of Dickinson's poems, including her envelope poems and fascicles, and extensive discussion of the lyrics and the ethical questions the work raises. Due to the nature of the subject of this essay, the research process provoked ethical questions of its own. The aim of this essay is to make clear the importance of teaching Emily Dickinson's work alongside her biography, and the importance of reading her work with the intention of studying the ethical dilemma that her work generates.

---

## **Electronic Structure and Mechanistic Study of Carbon Tetrachloride Dechlorination by [Cu(PDTC)X]-**

*Student Researcher: Mitchell Boyer*

*Faculty Mentor: Dr. Matt Queen*

*Department: Biological and Physical Sciences*

Carbon Tetrachloride (CT) is an organic solvent that can be found as a contaminant in soil and water. It historically found uses as a degreaser and fumigant to protect grains from insects. It was even used as a pesticide until 1986. CT is a suspected carcinogen and can severely damage the liver, kidneys, and in severe exposure cases, the nervous system. According to the Environmental Protection Agency (EPA), CCl<sub>4</sub> has been found in at least 430 of the 1662 National Priorities List (NPL). CT dechlorinates environmentally through a reductive process that leads to carcinogenic lesser chlorinated intermediates. The metal-ligand complex [Cu(PDTC)L]X features a tricarboxylic coordination to copper that stoichiometrically transforms CT into safer compounds (CO<sub>2</sub> and Cl<sup>-</sup>) bypassing lesser chlorinated intermediates. We use temperature dependent visible absorption spectroscopy to determine the activation energy associated with the dechlorination of CT for a series of halide complexes [Cu(PDTC)X]- (X = Br, Cl, I). We compare these activation energy to the sulfur and chlorine covalence values experimentally determined by S and Cl K-edge XANES. Interpretation of the results allows us to draw conclusions about the interconnectedness of the electronic structure and dechlorination function.

---

## **Can a Conventional Deadlift Exercise Reduce Low Back Pain in Physical Therapy Patients?**

*Student Researcher: Alyssa Cole*

*Faculty Mentor: Alex Shafer*

*Department: Health and Human Performance*

Low back pain is a common health condition affecting 50-80% of American adults. Traditional rehabilitation of the low back includes hip mobility/flexibility and core strengthening/stabilizing exercises. A conventional deadlift executed with proper form, promotes a neutral spine, core stabilization and hip mobility. **PURPOSE:** To determine the effect of performing a conventional deadlift routine on low back pain. It is hypothesized that the conventional deadlift will provide similar effects as the traditional low back rehabilitation program by reducing pain and improving function. **METHODS:** Forty

participants seeking treatment for lower back pain at an outpatient Physical Therapy (PT) clinic will be recruited to participate in the study. Potential participants will be screened for inclusion/exclusion criteria prior to participation. Half of those who agree to participate will be assigned to the experimental group and receive the additional deadlift exercise routine incorporated into the standard PT administered therapy sessions. The other participants will be assigned to the control group (PT without additional deadlifting). Each participant will complete the Oswestry Disability Index (ODI) during the initial visit, mid-point of treatment, and then again at the end of the intervention. The PT staff at the clinic have volunteered to administer the ODI assessment as well as the deadlifting intervention on behalf of the student researcher. **EXPECTED RESULTS:** Participant characteristics of age, sex, and injury history will be reported. ODI scores and length of treatment will be compared between groups using independent t tests. The results of this study can help to determine whether the benefits of strengthening of the core, hips and back musculature from the deadlift exercise improves patient outcomes beyond a standard low back rehabilitation program. Improving physical therapy treatment options for individuals with low back pain is a critical step in help individuals manage low back related pain and disability.

---

## Acetolysis of Yellowstone County Pollen Grains

*Student Researchers: Kandiss Dowdell*

*Faculty Mentor: Dr. Jason Comer*

*Department: Biological and Physical Sciences*

Allergies are the 6th leading cause of chronic illness in the U.S., with more than 50 million suffering from allergies each year. Symptoms of seasonal allergies include a weakened immune system, trouble sleeping, loss of concentration, fatigue, headaches, runny nose, itchy eyes as well as many other debilitating issues. The most common pollen allergens come from wind pollinated species, including trees and grasses. A key to understanding allergies is identifying the causative agent. Pollen grain architecture can be diagnostic at various taxonomic levels aiding in the identification or at least narrowing down the possible allergen candidates. In order to identify pollen to a specific taxon, pollen types must be described and reported. Descriptions of pollen types are often lacking for localized flora. The purpose of this project is to begin providing detailed descriptions and images of pollen types for the flora of Yellowstone County, Montana. The outer waxy layer of the pollen grains will be removed through acetolysis. Images will be taken using light microscopy and scanning electron microscopy. The data collected from these images are an important contribution to the scientific community that could result in better treatments for individuals that suffer from allergies.

---

# Understanding Point of Gaze During Free Throws in Collegiate and Recreational Basketball Players

*Student Researcher: Taylor Edwards*

*Faculty Mentor: Alex Shafer*

*Department: Health and Human Performance*

New technology such as eye tracking equipment can offer exciting opportunities to examine vision and gaze behaviors during motor tasks. **PURPOSE:** The purpose of this study is to analyze the location of gaze point between recreational and collegiate basketball players during free throws (FTs). This study will also examine and differentiate between the preferred gaze point of men and women collegiate basketball players. **METHODS:** Recreational (n=10) and collegiate (n=10) participants will complete two FT trials to determine if more experienced individuals exhibit different eye tracking patterns during closed motor skill performance. The first 20 FTs will act as the control trial. Each participant will then report the location on the rim or backboard that they focus on (point of gaze). After they establish that location, the participant will be instructed to shoot 20 more FTs while deliberately focusing on the reported location. Tobii eye tracking glasses will be used to record first person video of fixation point prior to release, as well as shooting accuracy for each shot. **RESULTS:** Descriptive statistics will be reported as means and standard deviations. Point of gaze preference such as front vs back of rim will be compared between recreational and collegiate basketball players. Additionally, differences in shooting percentage between groups will be assessed using an independent t test. Percent of FTs made for the control and experimental trials will be compared using a dependent t test for both groups. Finally, collegiate men basketball players gaze preference will be compared to previously reported female collegiate basketball players. **CONCLUSION:** Using the innovative technology of eye tracking glasses, results from this study may increase our understanding of the role of vision during the performance of a challenging motor task. This information will help support the growing body of research using a motor learning and control perspective.

---

# Encounters with Art: Research Through Exploration and Inspiration

*Student Researchers: Angel Shandy and Rachel Hamilton*

*Faculty Mentor: Dr. Rebecca Berru-Davis*

*Department: University Honors Program*

Exploring the art and religion of Spain and the Americas at the time of the Encounter is a multicultural and interdisciplinary venture when attention is placed on indigenous expressions and the Jewish, Muslim and African influences on visual culture. This is the approach we took in our Honors class, Art and Religion in Spain and the Americas, as we assessed the culture, religious imagery, spiritual iconography, and sacred spaces that were significant to these communities and continue to be important to indigenous, Latin American and U.S. Latino/a populations, today. In our readings, lectures, and research we learned the religious themes and meaning in paintings, iconography of virgins and saints, and artistic techniques related to wood and ceramics from Iberia to the Americas were often maintained and adapted over space and time. However, in this class of six students from varied disciplinary backgrounds we took our research a step further. We had a unique opportunity to carry out research on actual objects from a

donated collection of artworks. From this collection we compiled an exhibit titled Manos Inspiradas/Inspired Hands: Arts from the Americas which was shown on the MSU-Billings campus November 12-26, 2019. The exhibit showcased 30 pieces of art by anonymous artists inspired by their indigenous roots, environment, and their religious and cultural traditions. By researching, preparing, installing, interpreting and exhibiting the art we enriched the campus culture, created educational opportunities for the campus and local community, and inspired the imagination of the viewer. In the process, we also learned that every student's contribution was essential and valued. In our presentation we will share how this project-based research and our first-hand encounters with the art expanded our own perspectives and appreciation for varied belief systems and practices, cultural values and expressions, and ideas related to identity and community.

---

## **How the Menstrual Cycle Can Affect Anterior Cruciate Ligament Laxity in Female Collegiate Athletes**

*Student Researcher: Lauren Harshman*

*Faculty Mentor: Dr. Alex Shafer*

*Department: Health and Human Performance*

**INTRODUCTION:** Injuries to the anterior cruciate ligament (ACL) are synonymous with extensive rehabilitation programs, reparative surgeries, and missed competitive seasons for athletes. Numerous preventative measures can be taken in order to reduce the chance of ACL injury, yet some injuries are still unavoidable or inevitable. Especially more so for females, as females are two to eight more times more likely than males to sustain an ACL injury. Differences in sex hormones, particularly those that fluctuate within the menstrual cycle, have been investigated as a cause for this sex discrepancy, as it has previously been found that rises in these hormones can directly influence ACL collagen integrity. **PURPOSE:** The purpose of this study is to determine the relationship between heightened female sex hormone levels and ACL or knee laxity in female collegiate athletes. A secondary aim is to determine if the hormone steadying effects of hormonal contraception can produce more consistent ACL laxity measurements compared to those who do not take hormonal contraception. **METHODS:** Objective ACL laxity measurements will be measured via a K-1000 machine during each phase of 11 collegiate female athlete participant's menstrual cycle. The study population will be divided into two groups, those who currently take hormonal contraceptives, and those who do not. Differences in joint laxity for all three phases of menstruation between contraceptive users and non-users will be compared via a repeated measures ANOVA. **EXPECTED RESULTS:** Should ACL laxity fluctuate alongside the fluctuating female sex hormones of the menstrual cycle, it could contribute to the explanation of why females incur more ACL injuries than males. Should hormonal contraceptives decrease the variance in ACL laxity throughout a female's menstrual cycle, they can potentially be added to the list of preventative measures. Data collection is currently underway, and will be completed early-December, 2019.

---

# The Analysis of Posterior Deltoid Activation During Two Variations of a 90-Degree Horizontal Abduction Exercise

*Student Researcher: Chris Largent*

*Faculty Mentor: Dr. Alex Shafer*

*Department: Health and Human Performance*

Postural issues such as rounded shoulders are a common issue in society, affecting many who sit in front of computer screens, or at a desk for most of the day. Rounded shoulders are commonly included in upper cross-syndrome, which also includes a forward head posture, and thoracic kyphosis (Shingla, 2017).

**Purpose:** The purpose of this study is to analyze exercises for strengthening the posterior deltoid muscles and correcting upper-crossed syndrome. **Methods:** This study employs a quasi-experimental design to compare two different variations of a 90-degree horizontal humeral abduction exercise.

Electromyography (EMG) technology was used to assess muscle activation of the posterior deltoid between exercises. Ten participants age 18-35 were recruited to complete two horizontal abduction exercise protocols. The testing session required two different exercise variations including 90-degree prone dumbbell, and 90-degree horizontal abduction with TheraBand. The 10 participants completed each exercise for five repetitions, each repetition consisted of a 3 second concentric phase, and a 3 second eccentric phase. Results were recorded and compared to find which exercise incorporated the most muscle activation during the full movement and at beginning and end of the movement. **Results:**

Dependent t-tests indicated no significant differences in average posterior deltoid activation between the dumbbell (0.000218mv) and TheraBand (0.000249mv) exercise conditions, ( $p=0.52$ ). No differences were observed between TheraBand (0.00026391mv) or dumbbell (.00039mv) exercise conditions at the top of each movement for seconds 3, 9, 15, 21, 27, ( $p=.0.21$ ). Finally, there were no differences observed between dumbbell (0.00015mv) or TheraBand (.0001mv) exercise conditions at the bottom of repetition, seconds 6, 12, 18, 24, 30 ( $p=.0.21$ ). **Conclusion:** Both exercises resulted in similar muscle activation throughout the movement, and at the top and bottom of the movement. Dumbbell and TheraBand exercises are viable options for posterior deltoid strengthening and should be incorporated in upper crossed syndrome therapy programs.

---

## Fan Base Identification Through Simulation Theory

*Student Researcher: Daniel Lurie*

*Faculty Mentor: Dr. Samuel Boerboom*

*Department: Communications*

My study utilizes Jean Baudrillard's Simulation Theory to analyze the fan-oriented discourses produced by music duo Twenty One Pilots. In the study, I look at three research questions: first, how does Twenty One Pilots uniquely contribute to Baudrillard's notion of hyperreality in 2020?; second, how does the music duo create identification platforms for their fan bases through the usage of fictional worlds and alter-egos?; third, how does their rhetoric of alienation/surreality and the usage of alter ego/personality-based signs contribute to shaping a simulation? In my study I critique how Twenty One Pilots offer uniquely simulated hyperreal fan experiences through their music videos and fan-directed spaces. In addition to analyzing original band texts (music videos, online fan spaces), I also conduct a descriptive analysis of popular press articles that discuss Twenty One Pilots original approach to fan interaction and

engagement. This study is unique in the way that it extends how Jean Baudrillard would have viewed and analyzed the hyperreal simulated fan spaces. My research indicates that Twenty One Pilots creates a noteworthy connection to their fan base by creating a simulation for fanbases to identify with through Baudrillard's notions of hyperreality, pointed discourses, and symbolism.

---

## **Eyes burn bright**

*Student Researcher: Daniel Lurie*

*Faculty Mentor: Professor Tami Haaland*

*Department: English, Philosophy & Modern Languages*

“Eyes Burn Bright” is a segmented short story written from the second person perspective. It focuses on two unnamed characters, one male, one female, and outlines their thoughts and actions through real world struggles like isolation and a search for companionship. Each chapter alternates between their sub-stories, except for when both characters cross paths in one segment. The male character tries to distinguish what is real, whereas the female character tries to address isolation. Each segment is titled with an object, which is then personified and blended into the point-of-view. While the characters go about their actions, the world around them is plunged into chaos, but the catastrophe is never truly defined. The purpose of “Eyes Burn Bright” is to explain the internal struggles that individuals can face, even as major events are happening in the world around them, leaving the characters feeling alone in their conflict.

---

## **Development of an Elongator-Deficient Fungal Model for Screening Small Molecules That Rescue Polarized Growth**

*Student Researchers: David McGee and Cody Walters*

*Mentors: Dr. Lynn George, Joy Goffena and Dr. David Butler*

*Department: Biological and Physical Sciences*

Familial Dysautonomia (FD) is a neurological disease with both developmental and degenerative aspects including axonopathy of peripheral nerves. FD results from a point mutation in the ELP1 gene, causing reduced levels of the corresponding protein that functions in assembling a highly conserved, six-subunit complex known as Elongator. Elongator catalyzes the chemical modification of transfer RNAs needed for the efficient translation of codon-biased transcripts that preferentially use AA-ending codons. Like FD, axonopathies are a common feature of many other neurological diseases, including amyotrophic lateral sclerosis and Alzheimer's Disease. Despite their prevalence in neurodegenerative diseases, the discovery of therapeutics for treating axonopathies has been impeded by the difficult and costly nature of culturing primary neurons. Therefore, an experimental model that can withstand the manipulation required for a high throughput small molecule screen is essential for drug discovery. *Candida albicans* shows a pronounced polarized growth phenotype that is distinct among yeasts. To determine whether this phenotype is dependent on Elongator, as is polarized growth in neurons, we knocked out the ELP3 gene of *C. albicans*. Importantly, this knockout exhibits severely compromised polarized growth. Our long-term goal is to use this knockout to develop a high throughput screen for small molecules that can rescue

normal polarized growth. Molecules that rescue in our yeast model system, will then be tested in vitro for the ability to rescue axon elongation in elongator deficient neurons.

---

## **Rate of Plasmid Loss in Recombinant Yeast**

*Student Researcher: Karrah Peterson*

*Faculty Mentor: Dr. Paul Nash*

*Department: Biological and Physical Sciences*

Recombinant vaccines can be made in yeast and an understanding of plasmid retention in yeast in non-selective media can be a cost-effective way to manufacture these vaccines, especially in developing countries. What is the rate of plasmid loss in recombinant yeast under various conditions? Finding the rate of loss of a plasmid will be done by experimenting with yeast containing a plasmid with one of the genes for tryptophan (or uracil) production. Yeast with the plasmid will be able to make tryptophan and grow in media that does not contain tryptophan. Yeast with the plasmid will be tested in media with tryptophan (non-selective) and media without (selective). Yeast with the inserted plasmid will eventually lose the plasmid. Without selection, the number of yeasts without plasmid will continue to increase. The rate may be altered by factors such as protein production or incubation conditions as well as media formulations. Rate of loss can be calculated by monitoring the population over time and comparing the numbers of colonies of yeast with the plasmid that grow on selective media to the number of colonies of yeast with and without plasmid growing on the tryptophan media. Success will be the collection of repeatable data on loss rates.

---

## **The Consequences of Misidentifying Western Populism in the 21st Century**

*Student Researcher: William S. Segerstrom*

*Faculty Mentor: Dr. Samuel Boerboom*

*Department: Communications*

This research encompasses a six-month examination of the historical beginnings of populist, political rhetoric in the United States and Brazil. The foundations of Western Populism were derived from liberal democratic leaders and institutions in stark contrast to the populist rhetoric of Presidents Trump and Jair Bolsonaro spoken today. The concerns of this alarming political movement in our modern-day politics, and how it may endanger our fragile democracy, led to a deep analysis of the Trump/Bolsonaro phenomenas. Efforts to contact reporters at the news organization *Intercept Brazil*, founded by Pulitzer Prize award winning journalist Glen Greenwald, were eventually successful, as well as work and correspondence with journalist Victor Pougy of *Intercept Brazil*. Here, I received some inside information on the illegalities of Judge Sergio Moro, the possible ties the Bolsnorao family has to the assassination of Rio city councilwoman Marielle Franco, a close friend of Greenwald's family. Thus, I was aware of Moro's manipulation of Lula De Silva's corruption trial, information on the Bolsonaro family few in the United States were privy to which has now landed the Brazilian first family under investigation ala

Donald Trump. Roughly two months after my analysis was presented and published on Medium, the scandals around Moro, the federal prosecutors trying De Silva, Bolsonaro and his sons have rocked Brazil. "Lula", the popular ex-President jailed by Moro falsely (paving a way to Bolsonaro's unlikely election victory), recently walked free with his charges dropped. My research presents a firsthand account of false populism fooling the masses.

---

## **Encounters with Art: Research Through Exploration and Inspiration**

*Student Researchers: Angel Shandy and Rachel Hamilton*

*Faculty Mentor: Dr. Rebecca Berru-Davis*

*Department: University Honors Program*

Exploring the art and religion of Spain and the Americas at the time of the Encounter is a multicultural and interdisciplinary venture when attention is placed on indigenous expressions and the Jewish, Muslim and African influences on visual culture. This is the approach we took in our Honors class, Art and Religion in Spain and the Americas, as we assessed the culture, religious imagery, spiritual iconography, and sacred spaces that were significant to these communities and continue to be important to indigenous, Latin American and U.S. Latino/a populations, today. In our readings, lectures, and research we learned the religious themes and meaning in paintings, iconography of virgins and saints, and artistic techniques related to wood and ceramics from Iberia to the Americas were often maintained and adapted over space and time. However, in this class of six students from varied disciplinary backgrounds we took our research a step further. We had a unique opportunity to carry out research on actual objects from a donated collection of artworks. From this collection we compiled an exhibit titled *Manos Inspiradas/Inspired Hands: Arts from the Americas* which was shown on the MSU-Billings campus November 12-26, 2019. The exhibit showcased 30 pieces of art by anonymous artists inspired by their indigenous roots, environment, and their religious and cultural traditions. By researching, preparing, installing, interpreting and exhibiting the art we enriched the campus culture, created educational opportunities for the campus and local community, and inspired the imagination of the viewer. In the process, we also learned that every student's contribution was essential and valued. In our presentation we will share how this project-based research and our first-hand encounters with the art expanded our own perspectives and appreciation for varied belief systems and practices, cultural values and expressions, and ideas related to identity and community.

---

# Development of a Crispr-Cas9 System for Genome Editing in a Broad Range of Bacteria

*Student Researchers: Jordan Smith and Casey Skinner*

*Faculty Mentor: Dr. Tom Lewis*

*Department: Biological and Physical Sciences*

The aim of this project was to construct a broad host range plasmid-based CRISPR-Cas 9 system for use in bacteria. The components used to create this construct came from the SCAR-Less system of Reisch and Prather (2015). That system consisted of two plasmids with p15A and pSC101 origins of replication, which are not useful for many bacterial species. Components for one of the plasmid products were an sgRNA cassette under the control of a Tet operator, combined with an AraC-inducible lambda red recombinase for efficient rescue of the lethal effect of targeted double strand breaks in chromosomal DNA by custom double strand DNA. A second plasmid was constructed that contained Cas9 under Tet R regulation. The broad host range origins of replication chosen for use with those respective components were pBBR1 and RK2. Components were assembled by Gibson assembly. Initial tests of the system in *Pseudomonas aeruginosa* targeted the *pvdF* gene. Those experiments did not show the expected loss of recipient cell viability due to Cas9 expression, indicating no CRISPR nuclease activity and/or sgRNA expression. The new constructs have also been moved into *E. coli* for tests in parallel with the original SCAR-less system, and for determining which components are functioning as intended and which are not. Those will include cross-complementation experiments with combinations of the original, and the newly constructed broad host range constructs.

---

## Mind, Body, and Soul: Frankenstein's Creature

*Student Researcher: Mandi Stevens*

*Faculty Mentor: Tami Haaland*

*Department: English, Philosophy and Modern languages*

The central research question for my essay is how does analyzing Frankenstein's creature challenge what it means to be human? I will go about answering this question by first analyzing the physical aspects of the creature and what issues those aspects may raise, such as the complete ambiguity on whether the monster is made entirely of male corpse parts or if some female parts are included as well and the responsibility Victor Frankenstein has for the actions he made for creating the creature. I will then discuss the creature's impressively short journey to become educated, how big of a role the monster's newfound education plays in his misery and loneliness, and whether his logic can be considered human or be considered superior to the logic of humans. For the last part of my essay, I will provide a definition of human morality, or perhaps what humans generally believe having a soul means, and then I will bring up ethical situations the creature is involved in, such as his instinctual saving of a little girl and when he murdered little William Frankenstein. Defining what it is to be human is something that even the present-day struggles with, so I will most likely not have a solid answer to whether Frankenstein's creature can be considered human. However, I believe this analysis of Frankenstein's creature to be an important steppingstone toward figuring out what it is to be human.

---

## **Investigation of Ligand Lability Using P K-edge X-Ray Absorption Spectroscopy and Chemical Kinetics**

*Student Researchers: Alex Fryett, Devin Williams, Nickolas Ullman, James Unzaga*

*Faculty Mentor: Dr. Matt Queen*

*Department: Biological and Physical Sciences*

Carbon Tetrachloride (CT) is a carcinogenic industrial solvent and known environmental contaminant. The Department of Energy's Hanford Site has been identified as a Superfund Site where CT is just one of many environmental concerns. Environmentally, CT dechlorinates in a stepwise manner forming lesser chlorinated intermediate complexes that pose a health threat to humans. [Cu(PDTC)L] is a small coordination compound capable of dechlorinating CT into less harmful decomposition products: CO<sub>2</sub> and Cl<sup>-</sup>. In this study, we will test for any correlation between the dechlorination kinetics of CT of [Cu(PDTC)L] and the ligand lability of the L ligand. We will use P K-edge X-Ray Absorption Spectroscopy to quantify the phosphorus covalency of a series of PR<sub>3</sub> transition metal ligands [Cu(PDTC)L] (L= PPh<sub>3</sub>, PCy<sub>3</sub>, and PFuryl).

---

## **Comparison of Gas Chromatography Methods in Detection of Common Contaminants in Barrel-Aged Whisky**

*Student Researcher: Jason Van Hoorne*

*Faculty Mentors: Dr. Matt Queen and Dr. Rhonda Dillman*

*Department: Biological and Physical Sciences*

Analysis of five samples of commercially available barrel-aged whiskies will be performed using both GC-FID and GC-MS with both internal and external standards to determine concentrations of methanol, ethyl acetate, 1-propanol, 2-methyl-1-propanol, and 2-methyl-1-butanol. Limit of quantitation, precision, and accuracy will be compared between detection methods, internal versus external standard, and type of internal standard. Anticipated results will inform the feasibility of use of GC-FID over GC-MS as a lower cost method for detection of common contaminants in barrel-aged whiskies in the context of commercial whisky preparation regulations.

---

## **Elongator Function in the Pituitary and its Relevance to Familial Dysautonomia**

*Student Researchers: Cody Walters and Joseph Walters*

*Faculty Mentor: Dr. Lynn George*

*Department: Biological and Physical Sciences*

Familial dysautonomia (FD) is an autosomal recessive disorder that primarily impacts neurons in the autonomic nervous system (ANS). FD patients experience frequent autonomic crises that significantly impact their quality of life, and they also struggle to maintain normal body weight. The disorder is caused by mutations in the highly conserved gene *ELP1*. The consequence of this mutation is diminished production of the *ELP1* protein that serves as the scaffolding for a six-subunit protein complex known as Elongator. Elongator is essential for maintaining efficient translation by catalyzing chemical modification to tRNAs. Codon bias refers to the preferential usage of one synonymous codon over another, and our research has shown that in the absence of Elongator, large AA-biased mRNA transcripts are translated less efficiently, and small AG-biased transcripts are upregulated. POMC is a small, AG-biased gene encoding a precursor protein that is differentially cleaved to generate numerous key autonomic regulatory hormones including adrenocorticotrophic hormone (ACTH) and melanocyte stimulating hormone ( $\alpha$ -MSH). To determine whether POMC and its derivatives are altered in the absence of Elongator as a result of codon bias, we generated knockout mice in which *Elp1* is selectively deleted in *Pomc*-expressing cells of the pituitary and hypothalamic arcuate nucleus (*Pomc-Cre; Elp1LoxP/LoxP*). Although these mice weigh slightly more than their control littermates, they do not exhibit an overt autonomic phenotype. To generate a model that more closely recapitulates the human disorder, we next generated a double knockout in which *Elp1* is deleted in both *Pomc*-expressing cells and growth hormone-positive cells (*Pomc-Cre; Gh1-Cre; Elp1LoxP/LoxP*). Interestingly, these new knockouts weigh significantly more than controls. Exploring the effect of *Elp1* loss in these new mice will help us identify the specific pituitary and hypothalamic genes and pathways that are regulated by Elongator and may contribute to the autonomic pathophysiology observed in familial dysautonomia.

---

## **Density Functional Theory Investigation of [M(PDTC)L] Compounds for Use in Carbon Tetrachloride Remediation**

*Student Researcher: Devin Williams*

*Faculty Mentor: Dr. Matt Queen*

*Department: Biological and Physical Sciences*

Carbon tetrachloride (CT) is an organic compound that once widely used as an industrial solvent, degreaser, and grain fumigant. Improper disposal and ground water solubility issues led to CT being listed as a priority pollutant by the U.S. EPA. We are currently investigating the use of 2,6-pyridinedithiocarboxylic (PDTC) and its copper coordination compound  $[\text{Cu}(\text{PDTC})\text{L}]_x$  as a potential CT environmental remediation technology. We are interested in investigating the  $[\text{Cu}(\text{PDTC})\text{L}]$ -based CT dechlorination mechanism using Density Functional Theory (DFT) models. The unknown nature of the exact functional form of the exact exchange and correlation functional necessitates a broad empirical survey of possible DFT functional of the GGA, hybrid-GGA, and meta-GGA variety. In this study we test the ability of various DFT exchange and correlation functionals to reproduce experimentally measured orbital coefficient values for a series of  $[\text{Cu}(\text{PDTC})\text{L}]_x$  compounds.

---

# Effects of Exercise on Depression in Adolescents

*Student Researcher: Logan Yurt*

*Faculty Mentor: Dr. Alex Shafer*

*Department: Health and Human Performance*

**Background:** Most of the research investigating the mental health benefits of exercise is conducted in adult populations. Recent studies have shown increased physical activity time significantly lower depressive symptoms in adolescent populations (Penedo & Dahn 2005). However, research is limited on populations with clinically diagnosed mental illnesses. **Purpose:** The purpose of this study was to assess the effects of a 2-week exercise intervention on adolescents diagnosed with depression currently residing in a clinical treatment setting. **Methods:** Ten adolescents, male (n=5) and female (n=5) age 14-17 years diagnosed with depression were recruited from a residential treatment facility for youth struggling with mental illness. Participants were randomly assigned to one of two groups, an exercise intervention (n=4) and a control group (n=6). This study assessed the effects of a 2-week moderate-intensity aerobic intervention on depression in adolescents measured by the Beck Depression Inventory (BDI-II). **Results:** Based on the BDI-II outcome scores, a 2-week moderate-intensity aerobic intervention significantly decreased depression scores in the exercise group from pre (20.3±12.2) to post (13.3±13.5) intervention (p=0.033), but no significant changes were observed in the control group pre (27.5±9.4) to post (24.8±13.5) intervention (p=0.297). Additionally, there was no difference in the pre to post-intervention change score between the experimental (-7.0±4.9) and control (-2.7±11.5) conditions, p=0.249. **Conclusion:** One of the unique dimensions of this study is that it administered and assessed the effects of an exercise intervention on youth currently in a clinical setting receiving treatment such as cognitive behavioral therapy (CBT), which to current knowledge is the first to do so. An aerobic exercise intervention used in conjunction with CBT trends towards lowering depression symptoms in adolescents in comparison to those already receiving conventional treatment options. Future research should be conducted on the effects of exercise on depression and mood with a larger population size.

# **Special Thanks**

Patrick Williams: Program Cover Design

## **Sponsored and Supported by**

University Honors Program

Office of Grants & Sponsored Programs

