Greetings from the President

It is my distinct honor to welcome you to the 24th Annual Undergraduate Research Symposium at Minnesota State University, Mankato. Talented scholars have been assembled for your intellectual and personal enjoyment. What an exciting, but challenging, year of productivity for our students and faculty. Earlier this month, students made 26 virtual presentations at the National Conference of Undergraduate Research.

This year's symposium is a celebration of intellectual exploration, creativity, hours of labor and collaboration across students, faculty, and staff. Enjoy your time as you listen to oral presentations, engage in meaningful discussions with students at posters, and view presentations of visual and performing arts. It is, in part, because of these sorts of scholarly showcases that Minnesota State Mankato has come to be known for its Big Ideas and Real-World Thinking.

I want to express my appreciation for the efforts of the Undergraduate Research Center staff, the Undergraduate Research Council, and the many volunteers who have made this event possible. I also want to recognize the many contributions of our faculty and staff in promoting research, scholarly, and creative activities for our students. Your contributions to the intellectual development of these young scholars and their pursuit of excellence will last a lifetime.

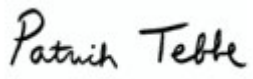
Once again enjoy your day as you are exposed to big ideas and real-world thinking in action.

Edward S. Inch
President
Minnesota State University, Mankato

A Message from the Undergraduate Research Center

Welcome to the 24th Annual Undergraduate Research Symposium at Minnesota State University, Mankato. The event features research, scholarly, and creative works from undergraduate and graduate students representing majors and disciplines from across campus. The symposium allowed undergraduates the opportunity to engage in the process of conducting and presenting research in an academic setting. This opportunity fosters collaboration between student presenters and an audience of faculty, administrators, peers, and family.

We congratulate these student presenters for their accomplishments and hard work throughout this year. We wish them the best of luck on their future academic and professional journeys.



Patrick Tebbe, Ph.D, P.E.
Director of the Undergraduate Research Center
Professor, Mechanical & Civil Engineering

Mission Statement of the Undergraduate Research Center

The Undergraduate Research Center (URC) nurtures and supports mentored research, scholarly, or creative activities for all undergraduate students. The URC promotes research as an opportunity to engage in a community of scholars to enhance students' academic experience and readiness to succeed in the future.

Visit the Undergraduate Research Center's website for more information on our programs:
https://research.mnsu.edu/undergraduate-research-center/

Thank you to the Minnesota State University Foundation

The Undergraduate Research Center wishes to thank the Minnesota State University, Mankato Foundation for their support of undergraduate research, scholarly, and creative work through funding for grants and student programming.

Undergraduate Research Symposium Inclusion Statement

We consider the Undergraduate Research Symposium to be a place where you will be treated with respect, and we welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability – and other visible and nonvisible differences. All presenters and attendees are expected to contribute to a respectful, welcoming, and inclusive environment for every other participant.

Accessing the URS – Virtual

The URS is being hosted digitally on the Symposium by ForagerOne system. The URS Welcome page can be accessed through the following link: https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium

Thank you to the Office of University Fellowships, Honors Program, and Undergraduate Research Center Staff

The Undergraduate Research Center wishes to thank the staff from the Office of University Fellowships, the Honors Program, and our administrative assistant, Pam Guss. This event would not be possible without your time and support.

Thank you to the 2021-2022 Undergraduate Research Council

Rachel Cohen

Shawna Petersen-Brown

Kristen Abbott Anderson

Heather McIntosh

Sheen Chiou

Bobby Bothmann

Jessica Albers

Corey Selland

Jeff Dennis

Mohammad Yamin

Areca Roe

Barb Bergman

Samantha Katner

Leah White

Kristel Seth

Kristen Cvancara

Barb Bergmann

Kerrigan Mahoney

Chris Corley

Minnesota State University, Mankato Foundation Grant Recipients

Alex Calli-Wehrman
Alex Ryno
Alexis Fronk
Ann Rogers
Ashley Bruehlman
Ashley Frick
Austen Bayne
Avery Enochson
Benjamin Glaus
Brooke Miles
Colleen Jackson
Cortiney Galuska
Daniel Schnabel
Eden Gebremariam
Emilie Greene
Emily Goodman
Emily Gregersen
Hunter Burgess
Ireland Manning
Jacob Dahlen
Jeremy Patricelli
Kennedee Weber
Lauren Lindmeier
Lelti Asgedom
Logan Johnson
Makenzie Reed
Mariefer Rodriguez Quevedo
Marius Vold
Muna Awel
Rachel VanKeulen
Riley White
Ritika Marsani
Ryan Callery
Ryuto Hashimoto
Samson Hamza
Shelby Lund
Taylor Grossen
Tensae Gonfa

Undergraduate Research Center Grant Recipients

Ellie Bungum
Emory Landis
Eric Patton
Haley Lechtenberg
Harrison Biying Wong
Jayden Kasiska-Pettersen
Jenna McCarthy
Joshua Gabrio
Joshua Vetter
Kacey Wachholz
Kenechukwu Okonkwo
Kyle Bouten
Liberty Hombe
MaKayla Ketterling
Molly Hill
Peyton Wolf
Ramsey Pankratz
Seth Nelson
Tanuja Kafle
Vanessa Kotek
Wynter Prudhomme
Yeabsira Dessie

CORNERSTONE

MINNESOTA STATE UNIVERSITY MANKATO

A Collection of Scholarly and Creative Works

Congratulations on presenting at the 24th annual Undergraduate Research Symposium at Minnesota State University, Mankato. Now that you have finished all your hard work and your poster, creative work or paper is ready for the Undergraduate Research Symposium, did you know that you can also submit a copy of your work to Cornerstone?

Cornerstone highlights the intellectual productivity and creativity of Minnesota State University, Mankato's faculty, staff, and students by preserving their works in this online repository and presenting them to the world to view. After the 2022 Undergraduate Research Symposium ends, Library Services will be adding the abstract booklet and proceedings to the repository as well. You can view the online collection at https://cornerstone.lib.mnsu.edu/urs/.

The proceedings include your name and the abstract of what you presented, but there is no full or complete text of your presentation, no view of your poster, or no images of your creative work. If you want, you can submit a full-text version of your work to Cornerstone which will be added to the proceeding record. Each item submitted to Cornerstone receives a permanent URL, which you can add to your resume to provide evidence of your hard work to prospective employers or graduate schools.

Did your project result in a research paper? Consider submitting it to the Journal of Undergraduate Research, which is also archived in Cornerstone at: https://cornerstone.lib.mnsu.edu/cgi/submit.cgi?context=jur. Authors must be MNSU, Mankato Students. The deadline for submission is May 10th, 2022.

When you submit a full-text work to Cornerstone, you will be able to see statistics on the number of times people have downloaded or viewed your work. For example, a presentation by Stephanie Bennett titled The Benefits of Exposure to Animals for Persons with Dementia: A Literature Review from the 2014 Undergraduate Research Symposium has been downloaded 813 times since it was added to Cornerstone in November 2014 and has been viewed by people from over 50 different countries.

If you are interested, we encourage you to talk to your faculty mentor or contact Heidi Southworth, Digital Initiatives Librarian at heidi.southworth@mnsu.edu with questions.

Schedule of Events — April 12th, 2022

Oral Presentation Sessions 1 & 2	10:00 am – 11:00 am
Poster Session 1	10:00 am – 11:30 am
Flash Workshop: "Finding Your Research Topic"	11:45 am – 12:15 pm
Office of University Fellowships Lunch	12:30 pm – 1:30 pm
Oral Presentation Sessions 3 & 4	1:30 pm – 2:30 pm
Poster Session 2	2:00 pm – 3:30 pm
Oral Presentation Sessions 5 & 6	2:30 pm – 3:30 pm
Keynote Address: "Undergraduate Research Students Tackle Cancer Research", Dr. Samantha Katner	3:45 pm – 4:15 pm
Faculty Panel: "Mentoring Undergraduate Students"	4:15 pm – 4:45 pm

A Brief Zoom-Facilitated Mindful and Intuitive Eating Intervention to Decrease Disordered Eating
McKay Gray, Seth Nelson, Eungyeong Lee

Clinical eating disorders are psychological disorders that impact a small percentage of the population. Subclinical disordered eating is a broader term for eating patterns and behaviors that do not meet clinical threshold, but that still may be life impairing (Burnette & Mazzeo, 2020). Subclinical disordered eating impacts many more individuals than clinical eating disorders do and is often present without the direct awareness of the people affected by it. Mindful and intuitive eating approaches have recently begun to emerge as combined and stand-alone treatments for disordered eating and eating disorders. Many of these studies have only evaluated each of these on their own, rather than in combination. Studies have also been limited in terms of population, with individuals with eating disorders making up the large majority of research subjects. The current study used an online mindful and intuitive eating intervention to bring about awareness of these concepts and combat disordered eating in lay adults through the use of simple workbooks (Albers, 2018; Resch, 2019). The goals were to increase education and decrease overall disordered eating. The authors found that disordered eating did decrease, mindful and intuitive eating increased, and general mindfulness improved across the duration of the study. While the hypotheses were partially supported, only the results for disordered eating and intuitive eating were significant. Despite lack of power due to small sample size and some insignificant results, participants verbally reported approval of the benefits of the intervention.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41424

Adjustable Ackermann design and testing for max performance
Esteban Loera, Cory Miller

Ackermann is an important variable of a steering system for any vehicle. The application in which our steering system will be used is for Formula SAE. Slip angles are also a big variable that is taken into consideration when designing a steering system. A slip angle is the difference between the direction the tire is pointing in and the actual direction the tire is going. The slip angle affects the instantaneous turn center making the slip angles a very important factor in steering. Ackermann is the geometry of the steering rack and tie rods that cause the inside wheel to turn at a greater angle than the outside wheel during a turn. Ackermann is good for taking tight turns at a slower speed because the inside tire takes the path of a smaller radius. There is also anti-Ackermann which has the opposite effects causing the outside wheel to turn at a greater angle than the inside wheel during a turn. Anti-Ackermann is used in very high-speed turn applications because there is a large amount of load transfer to the outside tire which causes the slip angles on the outside tire to increase. Parallel steering geometry, or zero Ackermann causes the wheels to turn at the same rate. This paper and presentation's focus will be on the design and manufacturing of a system that allows us to have adjustable Ackermann, research on whether we want pro or anti Ackermann, how much, and for what situations. Lastly, we will go over testing methods to validate our theories.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41029

An Evaluation of a Brief Mindfulness and Values Training on Cyber Bullying Behavior in College Students
Ellie Bungum

Cyber bullying is associated with many negative outcomes for both the bully and the victim (Fahy et al., 2016; Kowalski et al., 2014; Merrell et al., 2008; Quintana-Orts & Rey, 2018). There has been a large research focus on the causes (Barlett & Gentile, 2012; Mehari & Farrell, 2018) and consequences (Fahy et al., 2016) of cyber aggression, but there has not been as much focus on the evaluation of prevention and intervention strategies (Gaffney et al., 2018). While cyber bullying is primarily targeted in adolescence, Tynes, Rose, and Markoe (2013) showed that online aggression occurs amongst university students as well, resulting in a decreased sense of belonging to the campus community. One intervention that shows promise for the reduction of cyber bullying behavior is Acceptance and Commitment Therapy (ACT), which uses several techniques, including mindfulness and values techniques, to increase psychological flexibility (Christie, Atkins, & Donald, 2017; Villatte et al., 2016; Zarling, Lawrence, and Marchman, 2015). The current study aimed to evaluate the effectiveness of a brief mindfulness and values training for reducing the frequency of cyber bullying behavior in college students. Focusing primarily on the mindfulness and values components of the ACT package to determine whether they will be enough to effectively reduce cyber bullying behavior through increased awareness, compassion, and goal-directed behavior. A preliminary analysis of the data showed a decrease in cyber bullying behaviors from pre-test to post-test which continued into the follow-up. No changes in mindfulness were observed.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41426

An Evaluation of a Brief Mindfulness and Values Training on Cyber Bullying Behavior in College Students
Ellie Bungum

Cyber bullying is associated with many negative outcomes for both the bully and the victim (Fahy et al., 2016; Kowalski et al., 2014; Merrell et al., 2008; Quintana-Orts & Rey, 2018). There has been a large research focus on the causes (Barlett & Gentile, 2012; Mehari & Farrell, 2018) and consequences (Fahy et al., 2016) of cyber aggression, but there has not been as much focus on the evaluation of prevention and intervention strategies (Gaffney et al., 2018). While cyber bullying is primarily targeted in adolescence, Tynes, Rose, and Markoe (2013) showed that online aggression occurs amongst university students as well, resulting in a decreased sense of belonging to the campus community. One intervention that shows promise for the reduction of cyber bullying behavior is Acceptance and Commitment Therapy (ACT), which uses several techniques, including mindfulness and values techniques, to increase psychological flexibility (Christie, Atkins, & Donald, 2017; Villatte et al., 2016; Zarling, Lawrence, and Marchman, 2015). The current study aimed to evaluate the effectiveness of a brief mindfulness and values training for reducing the frequency of cyber bullying behavior in college students. Focusing primarily on the mindfulness and values components of the ACT package to determine whether they will be enough to effectively reduce cyber bullying behavior through increased awareness, compassion, and goal-directed behavior. A preliminary analysis of the data showed a decrease in cyber bullying behaviors from pre-test to post-test which continued into the follow-up. No changes in mindfulness were observed.

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Assessing a New Psychology Department Capstone Requirement
Halley Weinberger, Megan O'Connor

Recently the Department of Psychology changed the capstone requirements for undergraduate psychology majors in order to ensure that students were gaining information about preparing for careers and/or graduate school. In this study, we examined the effectiveness of these new capstone materials in preparing undergraduate psychology students to use the skills and knowledge gained in their undergraduate experience after graduation. The new capstone materials contain career and graduate school modules where students interact with readings, mini-lectures, and assignments relevant to their personal goals. This poster presents an online survey that was sent to 96 students who completed a Psychology capstone course in Fall semester, 2021. The survey included a number of open-ended questions about their memory of the capstone materials, skills and knowledge they gained from the materials, and which aspect of the materials was most beneficial to them. We will examine whether capstone materials are effectively preparing undergraduate students to enter the workforce or graduate school after graduation. Results may also show that capstone materials are not helping students prepare to enter the workforce or begin graduate school, indicating that the Department of Psychology should change their presentation of capstone materials or the materials themselves. Understanding the impact of capstone materials on undergraduate psychology students is important in order for the Department of Psychology to best prepare their students for the future.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41432

Automated Engine Control System
David Benson

While automotive engines have been able to control emissions better using fuel injection and feedback with an oxygen sensor in the exhaust, small engines are still carbureted with no oxygen sensor feedback. With no feedback, it is hard to control emissions. For emissions testing small engines, 40 CFR § 90 is followed. This CFR states a 6 mode test is to be done. Modes 1-5 are at wide open throttle with 100%, 75%, 50%, 25%, and 10% load. The 6th mode is at idle with no load, as shown in Figure 1. below and in Appendix A. Even with these tests, it doesn’t truly show how much emissions a small engine produces in the real world. Transient tests could be made possible by using an automated throttle, which would simulate a more real world situation than what the EPA test requires. In addition to transient tests, an automated throttle could be used to switch between mode 5 and 6 on the EPA 6 mode test. Using the current testing setup at MNSU, the throttle has to moved manually. This is a safety hazard that needed to be fixed.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41165

Bettina von Arnim and Civil Action: How to Defy Oppression by Championing Others
Tesla Gontjes

Children, cooking and church: Like most of the European world before 1900, these were "the three Cs" designated by society for women in Germany. However, some women broke through these expectations and pursued a fourth "C": Civil action. Such a woman was Bettina von Arnim (1785-1859). A writer, activist, feminist, and intellectual, von Arnim was politically active during a time when women were delegated to domestic duties and expected to be completely subservient to their husbands. She lived during a tumultuous era of French, Prussian, and Austrian occupation of Germany during the early 19th century. Instead of being a mild-mannered bourgeois widow, von Arnim interacted with many well-known German cultural figures, such as the Grimm Brothers, Goethe, and Beethoven. Like the politically active men in her life, von Arnim took action in an oppressive society, fearlessly voicing her own opinions while supporting other oppressed groups such as Jewish people, the poverty-stricken, and revolutionaries. While not well-known outside of German-speaking circles, von Arnim's contributions serve as an example of active citizenship despite being a member of "the weaker sex." Therefore, Bettina von Arnim is not only an important woman in German history, rather, an important person in *world history*.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41253

Calmodulinopathies and Oxidation Effects on Calmodulin Structure and Function
Eden Gebremariam, Samson Hamza

In living systems, calmodulin works as a mediator of calcium ion (Ca^{2+}) activities. Calmodulin (CaM) is a Ca^{2+} binding protein that interacts with many other proteins and serves as a the major intracellular Ca^{2+} receptor in eukaryotic species. In cardiac muscle, CaM mediates Ca^{2+} by interacting with a variety of transport proteins including the ryanodine receptor (RyR2) and the sarcoplasmic reticulum calcium ATPase (SERCA) which are both involved in calcium transport and excitation/contraction coupling in the heart. CaM contains an unusually high percentage of methionine (Met) amino acid residues within its primary sequence. The hydrophobic side chains of Met residues allows for CaM to interact with many of its binding partners. Met oxidation to methionine sulfoxide (MetO) or methionine sulfone has been shown to alter CaM's ability to bind and regulate its target proteins. In addition to oxidation of Met in the primary amino acid sequence of CaM, various point mutations have been discovered that lead to calmodulinopathies: a set of CaM protein related diseases causing severe cardiac pathologies. With the majority of cases, arrhythmogenesis in CaM mutations is caused by either delayed repolarization (as in long-QT syndrome, LQTS phenotype) or instability of the intracellular Ca^{2+} including catecholaminergic polymorphic ventricular tachycardia (CPVT). Each of these disease states can lead to cardiac arrythmias and sudden cardiac death. This research will focus specifically on two calmodulinopathy disease mutants: N98S and D129G. Our aim is to investigate the compounding effects of these disease mutations and oxidation on various aspects of CaM structure and function that may be relevant to a mechanistic interpretation of CaM mutation phenotypes, specifically for cardiac conditions. Structurally, CaM will be assessed to determine changes in protein folding and stability. Functionally, the ability of CaM to bind calcium as well as its ability to bind the cardiac ryanodine receptor (RyR2) will be evaluated.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41384

Circadian gene expression across reproductive phases in the green anole lizard (*Anolis carolinensis*) brain TL Grossen, AD Bunnam, RE Cohen
Taylor Grossen

Seasonal reproduction is associated with dramatic changes in reproduction such as increased gonadal steroid hormone production, changes in brain structure and increased reproductive behavior in the breeding compared to the non-breeding season. This annual pattern is largely regulated by changing environmental conditions, similar to the circadian rhythm system that regulates daily patterns. Several genes are responsible for creating the circadian rhythm and might also regulate annual rhythms, including *PER1*, *CIART1*, *CLOCK*, *BMAL* and *CRY*. For example, studies in seasonally breeding rodents have suggested that several circadian clock genes, including *PER1*, are differentially expressed across seasons. However, it is not known if the circadian system might regulate seasonal changes across vertebrates. To begin to address this, we examined the expression of several circadian genes in the hypothalamus of the seasonally breeding green anole lizards (*Anolis carolinensis*). Preliminary RNA-seq studies in male anole lizards (n = 3) revealed that *PER1* and *CIART1* might be upregulated in the breeding season. To confirm this observation, we performed quantitative real-time PCR on RNA isolated from the hypothalamus of breeding and non-breeding male and female anole lizards (n=10). We found no effects of season on *PER1* mRNA expression, suggesting that *PER1* levels are not altered seasonally in the anole. We are currently examining *CIART1* mRNA expression and are planning to continue analyzing the hypothalamic expression of other circadian rhythm products, including *CLOCK*, *BMAL*, and *CRY*. Understanding how the circadian clock is regulated seasonally in anoles may reveal a potential relationship between seasonal reproduction and the circadian rhythm system in reptiles.

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[redacted]
Shelby Lund, Alison Rutz

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Cooling Strategies for an Air-Cooled Engine in a Watertight Environment
Riley White, Tyler Blattner

Our project entailed installing a diesel-powered generator into a floating chassis of an electric Argo J8 robot. However, since the vehicle needs to float, it needs to be watertight on the bottom and sides of the chassis. Providing proper intake air flow and waste heat venting to an engine in this environment is crucial. To meet the cooling and intake needs of this engine, we designed and installed a "Hot-Cold Plate" which separate the chassis into two parts: hot side and cold side. The hot side houses the engine and exhaust, and the cool side houses the original electric portion of the vehicle. A hole was cut in the plate to allow the engine to pull fresh air from the cool side, preventing it from pulling hot air from the hot side, and prevent the air from both sides mixing. This cold air acts as intake for combustion and cooling. To supply the cold side with fresh air, a front access door was replaced with a vented door, allowing the cold side to have a continuous supply of fresh air for combustion and cooling. Lastly, when the engine is running it increases the temperature of the hot side of the vehicle drastically. Vents were cut in the top deck of the vehicle to allow this hot air to leave the chassis, while maintaining the watertight aspect of the lower chassis. Cooling tests will be ran to determine any required changes to the system, as well as to determine if any changes need to be made to the sizes of the vents on the hot side of the chassis.

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COVID-19 and the Impact of Physical Activity on Cognition and Quality of Life in Elderly Adults
Jenna McCarthy

The COVID-19 pandemic has had an overall negative impact on physical activity (PA). People who reduce their PA are subject to comorbidities including mood disorders (Puccinelli et al., 2021). This is significant for the elderly population as they are at high risk of mortality and other complications caused by contracting COVID-19. When older adults become more sedentary, their physical fitness is quickly lost due to reversibility (use or lose it). Due to the urge for the elderly population to isolate, as well as the restrictions and closure of facilities for the public, many elderly experienced reductions in PA and increases in sedentary behavior.
For those ages 65 and older, the recommendations for PA include 150 minutes of moderate-intensity aerobic activity per week and two days of muscle-strengthening activities that include all muscle groups (CDC). If they are unable to meet these recommendations it is recommended to aim to be as active as one is able. Although aging is inevitable, the quality of life is drastically improved with PA.

Quality of life (QOL) can be defined as an individual's self-perception about their physical, social, and mental well-being (Barbosa, 2019). Retaining physical and cognitive function to delay the onset of disability, illness, and chronic disease can be challenging for the elderly population (Cunningham et al., 2020). As people age, chronic diseases can occur due to organs beginning to deteriorate such as cardiovascular diseases, skeletal diseases, and mental disorders (Kazmenia, 2020). Chronic diseases have become more prevalent in the current population partly due to an increase in the average life expectancy. PA may prevent, treat, or reduce the severity of disability that can come from chronic diseases and has positive effects on the quality of life (Carta et al., 2021).
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[redacted]

Emilie Greene, Meaghan Keohane

[redacted]

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Critical Thinking about Workplace Problems: An Essential Skill for Students

William Kessler, Emory Landis, Andrew McCarty, Haley Lechtenberg, Jayden Kasiska-Pettersen

Critical thinking (CT) is a widely applicable skill and a desired asset by employers for college undergraduate students within any major. Education is thought to improve CT skills, a belief supported by numerous studies. However, these studies have largely focused on traditional academic definitions of CT as opposed to how CT skills relate to solving workplace-focused problems. Identifying the CT skills relevant to problem-solving in the workplace is crucial for preparing students for post-graduate success. This current study asks how the factors of personality and workplace experience relate to the ability to think critically and problem-solve in day-to-day workplace scenarios. The research in this study will provide insight into how real-world experience and personality may influence CT in a day-to-day workplace setting. Study participants are 130 undergraduate students at Minnesota State University, Mankato. They were given packets containing twelve workplace conflict scenarios and asked, "what issues, if any, are there in this situation?" These scenarios compel participants to use their CT, problem solving, and conflict resolution skills. After these scenarios, participants complete demographic questions and several personality scales. All authors on this project have worked to code the responses to the scenarios to examine whether participants can use their CT skills to successfully identify the problems in each scenario, and how this ability relates to their personality traits, level of work experience, and demographic qualities. Identifying whether past experiences or characteristics relate to ability to think critically in the workplace can help us better understand how to effectively prepare people to be successful in their careers.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41252

Development of Genetic Manipulation Techniques for the Fish Pathogen, *Flavobacterium psychrophilum*
Ritika Marsani, Carly Beveridge

Flavobacterium psychrophilum is a Gram-negative bacteria that produce proteins that cause tissue degradation leading to diseases like bacterial cold-water diseases (BCWD) and rainbow trout fry syndrome (RTFS), among salmonids. The manifestation of these infections includes skin ulcers, necrotic myositis, septicemia, and exophthalmia. Bacterial cold-water diseases are prominent when water is 16^{o}C and below. Among salmonids, *F. psychrophilum* mainly targets Coho salmon, Rainbow trout, Atlantic salmon, and Ayu. Adult fish are highly susceptible to necrotic lesion caused by BCWD whereas young fish is highly susceptible to hemorrhagic septicemia caused by RTFS. Global economic losses in aquaculture are caused due to BCWD and RTFS. Therefore, it is necessary to address the damages caused by infections caused by *F. psychrophilum.* The goal of this study is to develop genetic manipulation tools that can be used to understand the virulence mechanisms of *F. psychrophilum.* Specifically, we will construct helper plasmids carrying methyltransferase genes that can methylate and protect foreign DNA during conjugation between *E. coli* and *F. psychrophilum.* We have been cloning two methyltransferase genes from *F. psychrophilum* (*acuIM* and its downstream gene) into the pACYC184 plasmid. We plan to test if the helper plasmids carrying *acuIM* and its downstream methyltransferase would protect foreign DNA and increase the conjugation efficiency of *F. psychrophilum.* These tools will further allow us to generate avirulent or less virulent mutants that can be developed as live attenuated vaccines.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41289

Does leptin induce lipolysis?
Tensae Gonfa

The prevalence of overweight and obesity has increased in the United States over the last three decades. With its rising prevalence and associated health problems, obesity is an increasingly important medical and public health issue. In an attempt to solve this issue, we have proposed this research.

Through thermogenesis, brown fat produces heat and maintains body temperature primarily by consuming fatty acids. To do so, G protein-coupled receptors (GPCR) activate the phosphorylation (addition of a phosphate) of protein kinase A(PKA), which leads to the activation of hormone-sensitive lipase (HSL). Hormone-sensitive lipase facilitates the metabolic process lipolysis, where triglycerides (stored fat) are broken down into glycerol and three fatty acids. Once broken down, both glycerol and fatty acids are utilized by our body to fuel processes such as insulation and energy. Leptin, a hormone released from fat cells in adipose tissues, signals by activation of the JAK-STAT pathway, which ultimately leads to the phosphorylation of proteins called STAT. Although leptin has been shown to crosstalk with the GPCR pathway by inhibiting PKA in endothelial cells, it remains a question if it alters lipolysis in brown adipose tissues. This proposal tests a mechanism whereby leptin induces lipolysis by the cross-relation of the GPCR and JAK-STAT pathways in cultured brown fat. The amount of released glycerol will be measured in samples with Free Glycerol Reagent, which changes color proportional to the amount of glycerol present. Western blotting will then establish whether the phosphorylation of HSL is caused by leptin treatment. A higher ratio of phosphorylated to non-phosphorylated HSL identifies how much phosphorylation occurred due to leptin. This finding will allow us to have a better understanding of leptin's effect on lipolysis. Moreover, it will also enhance our understanding of treating several metabolic and obesity-related diseases.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41371

Effect Of Disinfectants On The Formation Of Biofilms By Methicillin-Resistant Staphylococcus *aureus* (MRSA)
Hannah Turnipseed

Methicillin-Resistant Staphylococcus aureus (MRSA) are Gram-positive cocci that cause a variety of bacterial infections. Infections involving biofilm-forming bacteria are extremely difficult to eradicate because biofilms impair antibiotic penetration and prevent normal immune responses. Biofilms are colonizations of bacteria in an extracellular polymeric substance matrix (EPS) that can attach to surfaces of an abiotic or biotic nature. The EPS made by the bacteria creates a barrier against antibiotics. To test the protectiveness of the biofilm created by Methicillin-Resistant Staphylococcus aureus, three strains were exposed to several disinfectants. The three strains of bacteria tested were 25923 (Methicillin-Sensitive Staphylococcus aureus (MSSA) forming no biofilms), 43300 (MRSA forming mediocre biofilms), and 6583 (MRSA forming strong biofilms). Biofilm formation assays were performed by using 24-hour bacterial cultures grown in TSB with 0.5% glucose at 370C. The cell suspensions were plated in a 96-well microplate and incubated for 24 hours at 370C in wells with no disinfectant and in wells pre-treated with different disinfectants. Uninoculated media was used as a background for the study. Wells were then washed with sterile distilled water. Cells were fixed with 99.9% methanol, stained with 1% crystal violet, rewashed with distilled water, and destained with 95% ethanol. A spectrophotometer analysis of optical density at 570 nm was used to determine the formation of a biofilm. The hypothesis is for the disinfectants to terminate the creation of a biofilm since disinfectants are used to kill or inhibit bacteria on several surfaces. Understanding the types of disinfectants that successfully halt the formation of staphylococcal biofilms can reduce the spread of infections caused by MRSA in hospitals or other environmental settings. The study will reveal the effects of different disinfectants on biofilm formation by Methicillin-Resistant Staphylococcus aureus.

https://symposium.foragerone.com/24th-annual-undergraduate-research-symposium/presentations/41208

Effects of retinoic acid on leptin in Brown Adipose Tissue Template
Yeabsira Dessie, Tsion Sherbeza

Understanding metabolic regulation has become increasingly important as the global obesity rate rises. One important aspect of energy expenditure is thermogenesis, a process whereby brown adipose tissue (BAT) produces heat to help maintain body temperature. This process increases the activity of uncoupling protein 1 (UCP1), a regulated protein channel which is found selectively in the inner mitochondrial membrane of BAT and allows BAT to make heat. Leptin is a hormone generated by fat cells in our body. When you eat, your body fat increases, and the numerous fat cells produce leptin. Its main target is the hypothalamus, a region of the brain that regulates energy balance by reducing food intake and increasing energy expenditure, including thermogenesis. Thermogenesis in BAT is also regulated by atRAwhich is synthesized from vitamin A, and functions to help cells differentiate and develop, acting as an activator of differentiated adipose tissue. One of the transcriptional targets of atRA is UCP1. Our work looks at the role of two key signals that affect thermogenesis: leptin, and all-trans-retinoic acid (atRA).
While it is clear leptin and atRA all regulate thermogenesis in BAT, the interrelationship between these signals is not well understood. To gain a better understanding, we will carry out an experiment to determine the effects of atRA on leptin synthesis and secretion.

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Effects of the COVID-19 Pandemic on Assisted Living Residents During Quarantine
Sydnie Schneider, Erin Dorn, Cecelia Anderson

When the COVID-19 pandemic emerged in the United States in January of 2020, it brought with it numerous restrictions for long-term care facilities. While these facilities established such restrictions with the health and safety of their residents in mind, they came with a downside of isolating residents from their families and loved ones. This qualitative study examines the relationship between pandemic restrictions in assisted living facilities and their resulting effect on residents. Researchers conducted an in-depth interview with individuals who lived in assisted living facilities throughout the pandemic. The study will shed light on these unheard stories and provide future recommendations and directions for long-term care facilities and clinical researchers alike.

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Effects of the COVID-19 Pandemic on Tenants who Resided in an Assisted Living Facility during the Quarantine
Sydnie Schneider, Erin Dorn, Cecelia Anderson

When the COVID-19 pandemic emerged in the United States in January of 2020, it brought with it numerous restrictions for long-term care facilities. While these facilities established such restrictions with the health and safety of their residents in mind, they came with a downside of isolating residents from their families and loved ones. This qualitative study examines the relationship between pandemic restrictions in assisted living facilities and their resulting effect on residents. Researchers conducted an in-depth interview with individuals who lived in assisted living facilities throughout the pandemic. The study will shed light on these unheard stories and provide future recommendations and directions for long-term care facilities and clinical researchers alike.

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Emerging Adulthood?Religious Vocation and Age in Seventeenth-and Eighteenth-century France
Ya Faatou Sowe

I am studying young women's vocation to convents in France. To do this, I examined convent registers, which provide data on religious vocations between 1620 and 1790. I collected key information such as names, date of vocation, age at vocation, the living status of parents, etc. The total database includes over three hundred females from five different convents located in Burgundy (an eastern province of France known today as Bourgogne-Franche-Comté). I have identified an increase in the average age of vocation and possible trends related to family strategies. This data may provide insight into changing ideas on conceptions about youth and transitions to adulthood over the course of the late seventeenth and eighteenth centuries. I further discuss possible implications of the data through analysis of royal edicts and ordinances, religious writings, and literary texts of the time.

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Jordan Kimmet, Morgan Rud

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Evaluating the impacts of Microplastics on Soil and Plant Health: A Greenhouse Pot Experiment

Cortiney Galuska, Vincent McKnight

Microplastics (MPs) have been studied extensively in terms of their impacts on marine life, but there is a much smaller body of research targeting the impact of MPs pollution on terrestrial ecosystems. This is particularly important given that many terrestrial plants form the basis of our economy and our diet. Furthermore, the presence of high concentrations of MPs can alter soil physical and chemical properties, which in turn may have negative effects on soil biological communities and their functions and plant growth and performance. Therefore, we will conduct a greenhouse pot experiment for 70 days to evaluate how different volumes and MP size fractions of Polyethylene Terephthalate (PET) will impact growth of tomato plants (*Solanum lycopersicum*) and the biological, chemical, and physical properties of soils. In addition to a control treatment, we will have nine MP treatments (three size fractions × three volumes × five replications), comparing MP volumes (relative to soil, W/W) of 0.1%, 1%, and 5% and size fractions of 0.5 mm, 1 mm, and 2 mm for each volume treatment. Tomato plants will initially be grown in single seed cells for an incubation time of 14 days. After incubation, the healthy tomato plants will be transferred to the one-gallon pots. Plant growth measurements (shoot length, flower/fruiting number) will be taken weekly, and the plants will be harvested at the end the study to measure root/shoot volume. Soil composition parameters will be measured pre and post treatment to test for significant differences in several physical (e.g., soil moisture content and soil compaction), chemical (e.g., pH, electrical conductivity, soil organic matter, macro- and micro-nutrients), and biological (e.g., microbial biomass, enzymes, and mineralizable nitrogen) soil health indicators. The knowledge from this study will increase our understanding of soil and plant health due to MP contamination on terrestrial ecosystems.

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Examining Empathy in Parent/Young Adult Relationships Using a Brief Solution-Focused Activity
Ashley Bruehlman

This mixed methods study examined (n = 77) the impact of a brief solution focused (Trepper et. al., 2007) activity to promote empathy and connection within parent/young adult relationships. Our study hypothesized that a brief solution-focused intervention between parent/young adult relationships would result in an increase of perceived empathy/connection. Quantitative findings highlight self-reported wellness scores for parents and young adults, along with perceived closeness. Additionally, quantitative findings show between group differences. Qualitative findings provide key insights into solution-oriented ideas collaboratively constructed by parents and young adults. Findings from this study may have practical implications for family life educators (CFLE), clinicians, and family advocacy efforts, showing where preventative and therapeutic efforts may be best channeled. Additionally, this study seeks to update and inform current and future studies.

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Exploring how technology influences college students' sleep
Makayla Ketterling

This study explored the impact of technology use on sleep disturbances in college students. All participants reported using technology within 30 minutes before going to bed. Significant correlations were observed supporting the hypothesis *technology is associated with sleep disturbances in college students*. There were numerous technology-related behaviors associated with specific aspects of sleep disturbance, but no single behavior affected all aspects of sleep. The correlations observed were small, explaining about 10% of sleep difficulties, but suggest that technology use can alter one's sleep in a meaningful way.

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Exploring Student Experiences With Group Work
Hailey Lundeen

Students often report dissatisfaction with group work in their classes. They may have a group member who doesn't participate, have team members who are not able to coordinate effectively, or they are assigned a project that could be completed by an individual, rather than a project that requires a group. The purpose of this study is to examine how college students feel about group work and what group structure components can be implemented by instructors to promote student success in group work. This research study is meant to find the gaps in student preferences and instructor support on various subjects such as grading methods, team contracts, project goal setting, project check-ins, group size, and assigned roles. A survey questionnaire was developed and administered to undergraduate students at a mid-sized, Midwestern University. Results present descriptive statistics and basic correlations for key study variables. The main findings were that students would like to have class time to work on projects, have role assignments, as well as a group contract for general rules. Students also concluded that they would like these contracts to reflect the grading method. Instructors can use these results to provide a better structure for class projects that are designed to promote teamwork.

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Filtration Capacity of Sand and GAC for Phosphate Removal
Molly Hill, Harrison Wong

This research project was conducted by civil engineering students, Molly Hill and Harrison Wong, at Minnesota State University, Mankato with the assistance of faculty mentor, Dr. Nazli Yilmaz Wodzinski. The project explores one method of removing phosphate from agriculture drainage water by using different thickness combinations of sugar sand and granular activated carbon (GAC). Unlike other methods of phosphate removal, this method can be used to treat contaminated water in the field. To simulate agriculture runoff, topsoil collected from the Ziegler farm in Mankato, MN was mixed with DI water. The mixture was run through filters, columns containing sugar sand and GAC, with phosphate levels measured before and after passing through the filter mediums. The results can be built on to find a feasible way to filter the nutrient-rich water present in Minnesota's agricultural runoff.

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Formula SAE Wiring Harness Design
Ryan Soltau

The goal of the project is to design and build a wiring harness for a Formula SAE car. The two main items of focus are functionality and data acquisition. The design process started out with gathering data on every electrical component critical for a Yamaha YZF R6 engine to run. Chassis sensors are used to monitor critical chassis parameters to determine adjustments needed and aid in driver development. The data acquisition system is comprised of 3 key modules, an Engine Control Module, a Power Distribution Module, and a Dash/Data Logger. These not only control engine function but can also monitor everything going on throughout the car. This makes it extremely easy to go back and change parameters to control engine function after doing runs on a dynamometer and be able to make chassis adjustments after doing chassis testing on a track. Having a data acquisition system is extremely beneficial for us being able make changes to the engine tune file and the chassis set up to make our overall car function at its highest potential.

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Function and Expression of Class I Ribonucleotide Reductases in *Flavobacterium johnsoniae*
Hunter Doheny

Ribonucleotide reductases (RNRs) are essential enzymes that convert ribonucleotides to 2'-deoxyribonucleotides. As both molecules are essential for cell survival, these enzymes and the genes that encode them are highly regulated. Bacterial RNRs have a variety of activation mechanisms that, in many pathogenic bacteria, differ from those used in human cells. This makes them an ideal target for antibiotic treatments. RNRs are divided into three distinct classes (I, II, & III), with class I having five subclasses (a-e). Many organisms have more than one class of RNR and new RNRs are still being discovered. Class Id, a novel RNR subclass, was shown to have an activation mechanism unlike previously studied class I RNRs. This enzyme has been shown *in vitro* to scavenge manganese and superoxide from the environment to become activated. To create an effective RNR targeting antibiotic, it needs to be understood how these enzymes function in vivo. *Flavobacterium johnsoniae*, the model organism for this study, has genes for both a class Ia and a class Id RNR. *F. johnsoniae* is a well-studied organism and there are many genetic techniques developed to manipulate it. *F. johnsoniae* is also the organism in which the first class Id RNR was discovered. Our preliminary data shows both the Ia and Id RNRs are functional. Preliminary gene expression analysis has also shown that both genes are expressed in the wild-type strain. We have generated 24 mutants lacking genes encoding the class I RNRs as well as manganese transporters, superoxide dismutases, and catalases. Growth analysis results for these mutants will reveal if endogenous changes of the manganese, superoxide, or hydrogen peroxide levels can affect the activation of the Id RNR *in vivo*. This research could provide the basis for the development of future antibiotic drugs that target these essential enzymes in pathogenic bacteria.

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Functional Investigation of the Type IX Secretion System Regulatory Pathway Components in *Flavobacterium johnsoniae*
Ireland Manning

The Type IX Secretion System (T9SS) is a protein secretion system unique to the phylum *Bacteroidetes*. The T9SS is a large complex composed of several different functional proteins that extend through the inner and outer membranes of the cell. This T9SS is responsible for secretion of high molecular weight organic polymer digesting enzymes, motility adhesins, and virulence factors in members of the *Bacteroidetes*. The T9SS gene expression is known to be regulated by a two-component system (PorX and PorY) and a sigma factor protein (SigP) in the human oral pathogen *Porphyromonas gingivalis*, a non-motile member of the phylum *Bacteroidetes* that causes gum diseases. Mutants lacking these regulatory components are deficient in secretion of protease virulence factors in *P. gingivalis*.
In this research, we aim to investigate the functions of the PorX/PorY two component system and SigP in *Flavobacterium johnsoniae*, a model organism for *Bacteroidetes* gliding motility and the T9SS studies. *F. johnsoniae* uses the T9SS to secrete adhesins along its outer membrane, allowing for gliding motility across solid surfaces. This organism also produces chitinase (ChiA) and proteases, enzymes that are required for digestion of chitin and proteins, respectively. We have created mutants lacking *porX*, *porY* and *sigP* in *F. johnsoniae*. Preliminary results show that the *porX*, *porY*, and *sigP* deletion mutants are deficient in chitinase and protease activities, suggesting that they may be involved in down-regulation of the T9SS gene expression.
This functional investigation provides more information about gene regulation of a relatively novel secretion system, as well investigating possibilities for drug therapies in pathogenic species of *Bacteroidetes.*

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Hermann in Imagination: How do selected narratives change how a figure is viewed in time and place?
Dominic Burns

The Varusschlacht was a battle in 9 C.E. that took place in Germanic regions of present-day northern Europe between three hardened Roman legions against oft feuding Germanic tribes. The outcome of the battle was an overwhelming slaughter of the Roman Legions. The victory from the Varusschlacht would turn the Cherusci leader Arminius, into a founding folk hero for all persons of Germanic descent. In the late 1800s, Monuments of the now named Hermann were constructed in both Detmold, Germany where the battle was believed to have taken place, and also in New Ulm, Minnesota. How do changing narratives affect the history being shared in differing time and place? How are Public Spaces employed in narrative? Can the statue of Arminius/Hermann in New Ulm be read as the establishment of maintaining German allegiance?

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Implementation of a High Dose Rate Irradiator for Living Samples Using 400kev Electrons
Samantha Sunnarborg, Preston Finger, David Markiewicz, Jackson Walters

Direct high dose irradiation of living samples was successfully demonstrated using extracted high energy electron beams from the Applied Nuclear Physics Lab accelerator. The analysis of effects on living samples allows for the determination of physical doses delivered. This allows the use of the Applied Nuclear Physics lab in future studies of radiation effects on synthetic and living systems in collaboration with other departments and industry. Electron beam energy and spatial distribution was investigated using magnetic steering and novel detection methods developed with Geiger-Müller counters. The experiments that followed included the use of radiation badges, fruit flies (Drosophila Melanogaster), and cellular assays to get organic and inorganic methods for measuring dosimetry. The radiation badge experiment suggests a minimum of 120-400 Grays per hour, a radiation dose consistent with the biological effects demonstrated in the fruit fly irradiations. It was found that this dose rate killed all fruit flies in one hour, while shorter irradiations caused delayed mortality of the population. Work is continuing to develop the methodology of cell assay irradiation to refine dosimetry.

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Implementation of Meaningful Engagements for Individuals with Dementia: Students' Perspectives
Jianna Gellhaus, Julia McCabe, Kaycee Ryan

Few appropriate activity programs exist for people with dementia. Meaningful activities enhance a person’s well-being and self-esteem. Student researchers facilitated engaging conversations with individuals who have dementia through 1:1 interaction using a dementia friendly memory book at a local memory care facility. Student researchers expressed their perceptions about aging and dementia and how the use of memory books had an impact on aging and having a fulfilling life.

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Improving Efficiency of Low-Income Housing
Jessica Reese

The goal of this study is to prove which areas of residential construction provide the best return on investment. Habitat for Humanity partnered with MNSU, Mankato to model and analyze common builds.
Energy 3D, a commercially available software, was used to simulate passive and active solar techniques to optimize energy efficiency according to recommendations from the Center for Energy and the Environment and DOE Zero Energy Ready Home Requirements.

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Improving Intake System Efficiency of a Restricted Formula SAE Engine
Benjamin Glaus, Alexander Ryno, Logan Johnson

This research project encompasses the study of improving the volumetric efficiency of an internal combustion engine's air intake system with the overarching goal of improving engine power output in a more fuel-efficient manner. The senior capstone project that we are a part of, called Formula SAE, requires all engines to use a 20-millimeter intake system restrictor--which can be thought of more simply as a small, roughly nickel-sized hole through which all of the engine's air must flow. From an engineering perspective, the restrictor inherently reduces the available air to the engine's cylinders, which reduces the engine's ability to produce torque and power which drive the vehicle. Researching ways to improve the intake system's efficiency not only benefits the Formula SAE project by extracting more power from the restricted engine, but also provides important insight into the future of internal combustion engines in modern vehicles. While continued technological developments in the field of fully-electric vehicles (EV's) make it apparent that EV's will undoubtedly be here to stay, there are still niche applications in which vehicles with internal combustion engines thrive. To keep their place in industry, internal combustion engines must be made as fuel-efficient and eco-friendly as possible. One way to achieve this is by lowering the displacement of the engine so that less fuel is required to be processed per engine cycle. A lower-displacement engine processes smaller quantities of fuel and air, much like the effect the intake system restrictor imposes on our Formula SAE engine. Throughout this research, improvements in interior part surfaces, internal geometries, and intake system packaging were explored in order to realize efficiency benefits, and thus produce sufficient engine power for the Formula SAE project vehicle, while maintaining a more fuel-economic state of operation.

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Daniel Schnabel, Ryan Callery, Jacob Dahlen

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MN Department of Human Services Background Study Disqualifications
Jill Sallstrom

There are many jobs in the State of Minnesota that require Background Studies by the Department of Human Services. Thousands of these applicants are being initially disqualified for a position due to something in their criminal background. After an application for a set-aside (appeal) some are no longer disqualified and able to proceed with employment. I have broken down the disqualifications by gender and race for 2018 and 2019. I have specifically looked at the disqualifications for crimes that are considered related to addiction and broken that down by type.

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MnDOT Bridge Maintenance Preservation
Luke Halstead, Harrison Wong, Taem Gelaw, Avra Chowdhury, Logan Josephson

Bridge maintenance and preservation activities are widely accepted to slow bridge deterioration rates and extend service life. In order to reflect the quantitative impact of bridge maintenance and preservation on bridge performance, State Departments of Transportation (DOTs) typically have utilized deterioration models or service life extension values that are based on expert elicitation. Research on quantifying the benefits of bridge preservation and maintenance, based on actual bridge data has been limited, if any. Therefore, there is imminent research need to quantify the impact of bridge preservation based on actual data sets for state DOTs. Proposed research will review and assess the maintenance history data collected by MnDOT, integrate it with relevant historic bridge condition and analyze it by incorporating relevant bridge characteristics. One of the research products will be decision trees that would be used by planners, designers, bridge engineers, and public works managers to guide the selection of cost-effective bridge maintenance actions. Research findings are anticipated to improve bridge preservation decisions in Minnesota and lead to more cost-efficient decisions.

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MNSU, The Green Campus : Now and Future
John Shrestha

The main objective of this research is to understand the present condition of the Minnesota State University Mankato in becoming a greener campus and also to see what the future might look like for the university in terms of a greener campus.

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Modeling and Forecasting Renewable Energy
Deepshikha Sanjel

Renewable energy sources are promising alternatives to fossil fuels (non-renewable energy). Renewable energy sources are clean, sustainable, safe, and environmentally friendly with little or no CO2 emissions. This reduces the dependence on fossil fuels, which in turn reduces environmental pollution. However, unpredictability in renewable energy sources such as solar and wind energy makes relying on these alternatives challenging.

The data have been collected from www.eia.gov. It is based on monthly data from January 1973 to September 2021, and we obtain forecasts for the next 14 months (October 2021 to Nov 2022).

This project aims to develop a model that can accurately forecast the future production and consumption of renewable energy in the United States. We utilize Autoregressive Integrated Moving Average (ARIMA) Model for modeling. Holt-Winters exponential method has been used for forecasting, found within the forecast package in R/RStudio. Finally, model validations have been tested using both visual (residual plots) and analytical (using p-values) methods.

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Modeling the Hodgkin Huxley Neuron Using Dynasim
Avery Enochson

The human brain allows us to interact with our surroundings, process the information we receive, and use it to learn, create innovation, and bring value to the world. This project focused on modeling a human brain neuron to help us better understand how the human brain functions. The neuron model was created in MatLab using a dynamical systems toolbox called Dynasim. Through the conjunction of these two tools, a human neuron model was constructed based on the traditional Hodgkin-Huxley model of a neuron. This model provided a visual and mathematical representation of a neuron firing when a stimulus current is applied. Once this model was fully constructed, it was expanded upon to eventually calculate the amount of oxygen consumed upon the neuron's firing. This allows for connection to Blood Oxygenation Level Dependent (BOLD) imaging which is the basis for functional magnetic resonance imaging (fMRI). This model is critical to advancing our understanding of the human brain. With a user-friendly model creation, it will hopefully be possible for widespread studying of the human brain to one day be attainable and accessible to all who are interested.

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Music & Personality
Ganwoo Nam, Maleah Berry

A variety of research address the relationship between music and personality and shows inconsistent results on the topic. The purpose of our study is to look at the relationship between music and personality in a local population with students in MSU, Mankato.

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Kennedee Weber

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Myosin oxidation and effects on Magnesium and actin binding
Lelti Asgedom, Muna Awel

Muscles are responsible for producing force throughout the human body. Muscle tissue is divided into three general types: skeletal, cardiac, and smooth muscle. Our muscles are prime targets of oxidative stress as they must respond effectively to influences such as exercise, hormonal changes, development, and aging. Repetitive muscle contractions lead to a variety of physiological responses including an increase in reactive oxygen species (ROS) production. ROS can affect all muscle types. Experimental research has shown that oxidation causes a functional decline in the actomyosin interaction as well as changes in myosin structural dynamics. Magnesium (Mg^{2+}) is a cation known for its regulatory role in the cell, including regulation of myosin's motor activity and binding to actin. Studies show that increasing concentrations of Mg^{2+} slows actomyosin ATPase and that both actin and nucleotide binding to myosin are both dependent on magnesium. The main goal of our research project is to explore the combined effects of oxidation and Mg^{2+} on actomyosin function including myosin ATPase activity and actomyosin binding interactions. In addition, changes in myosin's structure and stability will also be assessed.

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OSL and Mound Dating: Exploring the Use of Optically Stimulated Luminescence Dating to Establish the Chronology of a Native American Burial Mound at the Kiwanis Site
Marius Vold

Currently, there are no good and legal ways to accurately date Native American burial mounds. This project aims to investigate whether it is possible to extract viable samples for Optically Stimulated Luminescence (OSL) dating from burial mounds, using the Kiwanis site, in Eastern Wisconsin, to test out the method. Using OSL to date burial mounds has only been attempted a handful of times before, the previous attempts being met with limited success and degrees of uncertainty. This project differs in that it attempts to avoid the uncertainties in the previous work by using a different approach, using geophysical data to intentionally sample the floor of the mound, instead of the fill, and aims to extract core samples specifically intended for performing single-grain OSL dating, for a higher degree of accuracy. Using existing Ground Penetrating Radar (GPR) data from a mound at the Kiwanis site, we hope to pinpoint where we can safely extract core samples from the floor of the mound, as opposed to testing the fill used in the mound's construction, without encountering human remains, and make use of this information to attempt the extraction of core samples for later OSL dating.

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Physical Therapy Use Among Collegiate Dancers
Vanessa Kotek, Kacey Wachholz

INTRODUCTION: Collegiate dancers do not get the same recognition as other collegiate sports. Because of this, collegiate dancers often do not have access to athletic training facilities, health care information, or strength training personnel as those in recognized sports. Dancers often do not seek physical therapy when injured because they do not understand the severity of their injuries, or do not want to be told that they must sit out of their sport for an extended period. Rehabilitation with a physical therapist after injury is important for collegiate dancers' overall health. Given this research, collegiate dancers have high injury rates but low physical therapy's resources. Therefore, it is important to increase collegiate dancer's perceptions that would lead them to seek therapy when injured. The purpose of this study was to assess how a Health Belief Model information intervention impacts collegiate dancers' intentions to use physical therapy when injured.

METHODS: The NCAA database was used to identify collegiate dance teams. Participants were recruited by emailing coaches and messaging their collegiate Facebook pages. The study included a pre-test survey, the HBM information intervention, followed by a post-test survey. The survey included questions about their demographics (pre-test only), prior physical therapy and injury experiences (pre-test only), perceived barriers and benefits of physical therapy, susceptibility and severity of injury, and intention to seek physical therapy when injured. The intervention was an infographic based on the Health Belief Model that included information on background/modifying factors, threats and expectations of perceptions, and the actions that impact behavior.

RESULTS and CONCLUSION: To be presented at the Undergraduate Research Symposium.

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Pre-methylation of foreign DNA improves conjugation efficiency in the fish pathogen, *Flavobacterium psychrophilum*
Seada Sloboda

Every year, millions of dollars are spent to combat outbreaks of fish diseases due to the presence of fish pathogens, such as Flavobacterium psychrophilum, a member of the phylum Bacteroidetes. F. psychrophilum is the causative agent of bacterial cold-water disease (BCWD) and rainbow trout fry syndrome (RTFS), predominantly in salmonids. The bacterium causes tissue damage and tail rot in young and adult fish. The issue is prevalent in fisheries in the Pacific Northwest and the treatments often entail the use of antibiotics. The virulence mechanisms of F. psychrophilum are not well understood. Genetic manipulations in F. psychrophilum CSF 259-93, the most problematic strain in rainbow trout fisheries in the U.S., are scarce, due to the strain's ability to destroy foreign DNA via its restriction enzymes, which hampers the identification of virulence factors by using genetic tools. The goals of this project are to identify methyltransferase (MTase) genes of the DNA restriction-modification systems in F. psychrophilum CSF 259-93, and improve the efficiency of DNA transfer via conjugation by pre-methylation of foreign DNA. Individual or multiple MTase encoding genes were cloned into pACYC184, a compatible vector with the reporter plasmid pCP11. pACYC184 derived plasmids carrying the MTase genes were co-transformed with pCP11 into the conjugation donor E. coli for pre-methylation of pCP11. Two MTase genes (hpaIIM and scrF1M) were identified and shown to be effective in improving the conjugation efficiency in CSF 259-93 using pCP11. A helper plasmid (pSS05), containing both hpaIIM and scrF1M genes, was constructed and a more significant increase in conjugation efficiency of pCP11 was observed by using pSS05. We further generated a deletion construct pSS12 to delete gldN, a component of the type IX secretion system required for the virulence of F. psychrophilum. By using pSS12 and the helper plasmid pSS05, we successfully constructed the gldN deletion mutant. We intend to test this newly developed pre-methylation/gene deletion method in other virulence factors of interest. Our goal was generating avirulent or less virulent mutants. These mutants can be developed as live attenuated vaccines and used to prevent BCWD and RTFS diseases, and thus to reduce the economic losses in aquaculture.

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Predicting Factors for a DFW in CHEM 191
Ashley Flynn

This research was conducted to look at possible predictive factors for students receiving a D, F, or withdrawing (W) (DFW) from the Chem 191 course at Minnesota State University, Mankato. The course is considered a general education requirement for engineering majors. The DFW rate from looking at the last seven years of data shows that 22% of students who enrolled in the course received a D, F, or withdrew from the course. The factors looked at include, but are not limited to, gender, high school GPA, international vs. domestic students, students of color, age, and race. Statistics were run using logistic regression analysis to determine if there were any significant factors that could be seen as predictive factors. Being a student of color showed a 15% higher DFW rate than their peers. Due to this, tests were also done to look at the grades vs. the withdrawal rates for students of color and found that the withdrawal rate alone was 13.3% for students of color and 4.8% for students who identify as not being a student of color. First-generation students also showed a significant difference in DFW rate, having about a 12% higher DFW rate than those students who did not identify as first-generation college students. Seen also to have a higher DFW rate was students who identified as a freshman compared to those who identified as a sophomore, junior, or senior. Once these factors are determined, interventions can be set in place to help these students succeed in Chem 191.

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Presence of African American English in Narrative Samples
Amanda Biastock, Katie Ebeling

African American English (AAE) is described as the varieties of English spoken by Black people in the United States. AAE is distinguished by phonology, morphology, syntax, semantics, and pragmatics (Holliday, 2018; Green, 2002, as cited in Hendricks et al., 2021). Little research has been done comparing the use of AAE features when communicating with a speech-language pathologist who is African American versus white. Previous studies show that racial matching in the mental health field has been linked to "increased utilization, favorable treatment outcomes, lower treatment dropout, and greater satisfaction" (Meyer & Zane, 2013). Clients also feel more comfortable with a clinician of the same ethnicity because they have shared commonalities in culture and values (Meyer, Zane, & Cho, 2011; Sue & Zane, 1987; Zane et al., 2005). The purpose of this study is to compare the syntactical use of African American English in the presence of a clinician who is white versus African American. Narrative samples were collected from African American children. Each child provided a sample to a white clinician and an African American clinician. The AAE features were tallied and analyzed, showing that there were no substantial difference in number of features between the SLPs.

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[redacted]
Rachel VanKeulen

[redacted]

Relationship between APOBEC3A and Herpes Simplex Virus 1 UL39
Maria Rodriguez Quevedo

The protein APOBEC3A (A3A) is an enzyme that belongs to a human family of DNA-cytosine deaminases which act as an immune defense against multiple kinds of viruses. These types of enzymes achieve deactivation of viruses by deaminating Cytosine (C) to produce Uracil (U) in single stranded DNA. Understanding the protein-protein interactions of A3A with different viral proteins is of great interest since it gives rise to the opportunity of manipulating these interactions for the development of new treatments. This study aims to visualize the interaction between A3A and the viral protein that is produced by Herpes Simplex Virus 1 (HSV-1) gene UL39 using confocal microscopy. The gene UL39 is of interest since it codes for the large subunit of ribonucleotide reductase, an enzyme responsible for converting ribonucleotides to deoxyribonucleotides, an essential reaction for DNA synthesis. We expect that A3A will interact with the protein coded by UL39 since it has been previously shown that it counteracts the antiviral effects of A3A by eliminating the enzyme from the nucleus, where viral replication occurs. The visualization of A3A and UL39 can give us an insight into the strength and colocalization of this protein-protein interaction. Currently, effective therapies for the treatment of HSV-1 infections are limited, and infections caused by this virus can be life threatening to infected neonates or immunocompromised individuals. This study aims to provide evidence that can be used for further studies for the development of new HSV-1 treatments.

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Repressing APOBEC3 Proteins with Micro RNAs to Reduce Cancer-Causing Mutations
Joshua Vetter

APOBEC3s are a group of proteins that have widespread influences and effects on human immunity and cancer. APOBEC3s have the ability to inhibit many serious viruses such as Human Immunodeficiency Virus, Human Papilloma Virus, and Hepatitis B Virus. In addition to their viral implications, APOBEC3s play a crucial role in cancer and its progression. APOBEC3 proteins are expressed to a high degree in cancer patients, especially those whom viral infections have impacted. Because of this, it is hypothesized that downregulating APOBEC3 protein translation will result in fewer cancer-causing mutations, thus limiting cancer and its progression. Our research aims to study this phenomenon through the use of repressive micro-RNA molecules. Currently, in our research, we have delivered various micro RNAs into a human cancer cell line to gauge their repressive effects. To test whether a micro-RNA has repressive effects, we have utilized the dual-luciferase assay system. In this system, the region of APOBEC3, which miRNAs would target, is fused to the light-emitting genes from a sea pansy. A second light-emitting gene from a firefly is expressed independently. If the micro-RNA has a repressive nature, sea pansy, but not firefly, light emission should be lowered when read on a luminometer. From the dual luciferase assay system, we found that miRNAs 548 and 1207 repressed APOBEC3 protein translation significantly compared to a control. These results, however, were unable to be duplicated, but we came close. We also found that miRNA 1227 showed signs of repression, but the error margin was too wide to be considered significant. These results indicate a positive outlook for the downregulation of APOBEC3 protein translation; however, further experimentation must be done to make a definitive statement.

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Role of Noise in the Neuronal Ability To Encode and Classify Signals
Mohamed Zakariya

The brain is an intrinsically noisy environment. Neurons and networks are able to detect and classify different natural signals. The specific role played by noise in the codification of information is broadly unknown. The common picture of noise as a factor that can only cause a deterioration of the information in the signal is coming from linear systems. Most of the neurons in the brain and the mathematical models to represent them operate as excitable systems, which are nonlinear systems. Once nonlinearities are considered, noise can improve the codification of the signals. These improvements are usually called stochastic resonances. The first described stochastic resonance was obtained as an improvement in the response of a nonlinear system to a periodic input signal. This idea was later extended to more naturalistic relevant signals (aperiodic input signals), and referred as aperiodic stochastic resonance. In this study, we explore the significance of aperiodic stochastic resonance for the codification and classification of chaotic signals by a single neuron modeled using well established neuronal mathematical models. We analyze different metrics to quantify stochastic resonances, and the connection to a machine learning classification problem.

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Seeing the Effects: Developmental Thyroid Disruption and Photoreceptors
Jessica Wimp, Ainslee Hemmen

Although thyroid hormone is best known for its role in regulating metabolic function, it is also an essential factor in the development of the nervous and sensory systems (Bernal 2005). For example, in the visual system, thyroid hormone is reported to regulate the expression of photoreceptor opsins in development which are vital for color vision in mammals (Lu et. al 2009). Considering the importance of thyroid hormone in the development of the nervous and visual system, there is concern that man-made chemicals released into the environment may disrupt thyroid hormone dependent development and cause permanent neurological or sensory deficits. However, most of the existing research only considers severe developmental hypothyroidism (very low thyroid hormone). Therefore, the sensitivity of developing systems to perturbations in thyroid hormone, as well as the degree to which circulating levels of thyroid hormone must be reduced to observe an adverse outcome, are largely unknown.

Our research is focused on understanding the relationship between serum thyroid hormone levels and gene endpoints of thyroid hormone action. Mice were treated with increasing doses of a thyroid hormone inhibitor to induce graded levels of thyroid hormone insufficiency. Eye tissue was collected, and total RNA was isolated. Following reverse transcription, the levels of retinal opsin mRNA - medium wavelength (M), short wavelength (S), Rhodopsin - are being quantified by real-time PCR. Our goal is to understand the degree to which thyroid hormone levels must be reduced to observe changes in retinal opsin mRNA levels. This work will provide critical information on the sensitivity of the developing visual system to thyroid hormone disruption, important information for the regulatory domain.

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SIVmac239 Vpx Nuclear Import
Hunter Mayhew

Vpx is a Human Immunodeficiency Virus type 2 (HIV-2)/Simian Immunodeficiency Virus (SIV) protein whose activity permits successful viral infection of non-dividing cells. The two principal functions of Vpx are mediating nuclear import of the HIV-2/SIV reverse transcribed genome and antagonizing SAMHD1, a host-cell innate immune protein primarily localized in the nucleus. Previous studies have identified multiple mechanisms of Vpx nuclear translocation, including Importin-α/β dependent and independent pathways that rely on multiple non-canonical nuclear localization signals (ncNLS) and phosphorylation by MAPK/ERK-2. Although predominantly found in the nucleus, concurrent or exclusive Vpx localization in the cytoplasm has been observed in specific cell types and a subset of HIV-2/SIV strains. We observe that HIV-2 ROD9 Vpx demonstrates significantly higher nuclear localization in HeLa cells compared to Vpx proteins from HIV-2 7312a and SIVmac239. This discrepancy is likely due to key amino acid differences that impact nuclear import and/or export pathways exploited by Vpx. To investigate amino acids relevant for nuclear import, site-directed mutagenesis was executed on SIVmac239 Vpx to increase its homology to HIV-2 ROD9 Vpx. HeLa cells were transfected with various Cherry-tagged SIVmac239 Vpx constructs followed by treatment with leptomycin B (inhibits nuclear export). Representative cells were then imaged with confocal microscopy and used to quantify localization patterns displayed by each Vpx construct. Interestingly, our data from the SIVmac239 V67T Vpx construct suggests that other residues outside the C-terminal 65-SYTKYRYL-72 minimal ncNLS must contribute to efficient Vpx nuclear uptake. Collectively, these various constructs help narrow down the particularly relevant nuclear localization mechanisms for this virus in HeLa cells and serve as a platform for additional study in other biologically relevant cell types, such as macrophages. By providing greater insight into viral nuclear import, these data may galvanize the development of effective HIV-2/SIV therapeutics that target commonly exploited host-cell nuclear entry pathways.

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Soil Carbon Inventory and Aggregate Stability of Conventional Tillage and Orchard with Continuous Living Cover
Mason Sweet

We sampled soil cores on four soil types in a field that has been under conventional corn and soybean rotation with tillage for decades. As a study control, we sampled the same four soil types from a neighboring field that has had continuous grass cover and orchard crop for more than 20 years. We used the Slakes application to measure the aggregate stability of A horizon soils. We measured organic carbon and nitrogen and using bulk density we calculated carbon inventory to at least 50cm deep. We hypothesize that the carbon inventory of the orchard plot will be greater and that the aggregates will be more stable than the conventional tillage plot. This comparison study will serve as a baseline of soil properties to measure the annual impacts of conversion from conventional tillage to poultry silviculture.

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Subcellular Localization of FAM171B in Endosomes of Neurons
Emily Gregersen, Jenny Vetter, Sheebong Zama-Chi

FAM171B is a novel protein containing a polyglutamine (polyQ) tract. Polyglutamine tracts in proteins are linked to neurodegenerative diseases such as Spinocerebellar Ataxia and Huntington's disease. Not much is currently known about novel protein FAM171B and its normal function within cells. Using cell biology techniques such as transfection and immunofluorescence, we observed the location of FAM171B with relationship to late endosomes. Our research results suggest that FAM171B and late endosomes are found in the same areas of the cell but did not definitively show overlap of FAM171B and late endosomes. These experiments allow us to learn more about the normal function of FAM171B, which will further the studying of FAM171B and its relationship with neurodegenerative diseases.

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Synthesis of Imidazoline and Oxazoline Products Via a Novel Reaction Mechanism
Ramsey Pankratz, Eric Patton

One of the primary protein regulation mechanisms involves the proteosome, which is a large, multi-subunit protein found in the cytoplasm of living organisms. For various human diseases and infections, treatment can include decreasing or adjusting proteosome activity, depending on the situation, because careful regulation of the proteosome is crucial for cell viability. Recently, imidazolines and oxazolines have shown great promise in proteosome inhibition. Previous research has led to the discovery of a novel pathway to access oxazolines in fewer stages than current methods, through the potential formation of an inter-halogenated species. In this study, the mechanism by which oxazolines can be easily synthesized from amides was further elucidated. Additionally, the oxazoline products were evaluated for pharmacological relevance using cell viability assays and drug studies utilizing cancer cell lines. It is anticipated that the oxazolines will function similar to imidazolines, and deregulate the proteosome, resulting in cancer cell death. The successful synthesis of oxazolines opens up a novel organic mechanism that reduces the time required to produce the desired end products. Furthermore, the mechanism can be easily modified to produce imidazolines, which have already been shown to regulate the proteosome and cause cancer cell death. Overall, this reaction will reduce costs of production because it uses industry standards, which are affordable to obtain, and would eliminate the need for palladium to select for specific stereochemistry.

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Teaching Microaggression to College Students through Stimulus Equivalence Procedure
Sophia Venner , McKay Gray , Prajita Chauhan

The term microaggression is used to describe daily verbal, behavioral, or environmental occurrences that communicate hostile, derogatory, or negative messages towards stigmatized or culturally marginalized groups (Sue et al., 2007). Whether intentional or unintentional, the message of these verbal and nonverbal behaviors is to invalidate the identities, realities, or cultural practices of people belonging to a marginalized group (Sue et al., 2007; Sue, 2010a, p.3). The existing research on microaggressions focuses on examining how different demographics experience microaggressions, the influence of intersecting identities, and how microaggressions are expressions of oppression. Previous studies have focused on college students and their experiences with microaggressions, however little research has been conducted on the prevention of microaggressions or effective interventions. The field of behavioral analysis has demonstrated potential in reducing bias through the use of derived relational responding (DRR), which allows for the emergence of associations between stimuli that have not been directly taught (Matsuda et al., 2020). The current study aimed to teach college students microaggression terminology that will aid in their understanding of microaggressions. Results and implications will be discussed.

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Team Survivor Strong URS Final Presentation, Spring 2022.
Mohamed Abdi

Team Survivor Strong was tasked with creating a custom wheelchair for a disabled dog named Survivor. In the presentation, I described the process that the engineering team went through to meet Survivor's specific mobility-related needs over the past 2 semesters.

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The Creation of a Montessori Based Activity: A Memory Book
Alexis Fronk, Elizabeth Chua, Courtney Warren, Julia Swanson

The purpose of this study was to examine how a dementia friendly memory book following Montessori-based principles is created. Research participants included 17 undergraduate students and 12 interviewees. Undergraduate students selected a timeline based on the common age for individuals with dementia, took steps to create a memory book based on Montessori-based principles, conducted interviews to ensure accuracy of memory book, and compiled feedback from the interviews to modify content. The result was a memory book that was meant to facilitate meaningful and engaging conversations for individuals with dementia.

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The Effect of Concussion Information Quality on Youth Athlete and Parent Perceptions and Behavior
Eleanor Fitzwilliams

In response to the dangers posed by youth sports concussion, all 50 states and the District of Columbia have passed laws attempting to protect youth athletes. One key principle of these laws is providing information to both parents and athletes. However, both the quality of provided information- and the role this information plays in affecting attitudes and behavior- remains unclear. This study sought to evaluate the quality of concussion information and attitudes towards concussion in a broader cross-section of youth athletes and parents typically captured by the literature. We also identified gaps in knowledge regarding concussion management amongst both parents and adults. These results indicate there are discrepancies between youth athletes and their parents regarding the concussion importance and risk. Promisingly, currently provided pre-season concussion information may be associated with increased knowledge in certain domains, such as reporting behavior in youth athletes and knowledge of state return to play laws in parents. However, this information may fail to increase awareness of proper management, indicating a possible area for improvement.

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The Effect of Sodium Perchlorate on Testi and Ovary Development
Kyle Bouten

Perchlorate is an aquatic contaminant that has been known to affect thyroid function in vertebrate animals, as well as humans. Perchlorate is commonly used in rocket propellants, fireworks, road flares, and many other commercial uses. The widespread use of perchlorate has led to individuals of industrialized countries to be constantly exposed to this chemical. Studies in fish have shown that perchlorate inhibits reproductive function in both male and female stickleback without disrupting normal thyroid function. Because of these effects, we hypothesized that perchlorate exposure will cause reproductive abnormalities in mice (*Mus musculus*). The present study exposed mice after weaning (37 days post birth) to two environmentally relevant concentrations of sodium perchlorate and a control (10ppm, 100ppm, and 0ppm) in their drinking water for 49 days. Mice were euthanized and gonads were dissected, preserved in formalin, embedded in paraffin wax, section and stained with hematoxylin and eosin. Testis sections were photographed and analyzed for Leydig cell nucleus area, circumference of seminiferous tubule and lumen, the presence of germinal vacuolation and disorganization of tubule morphology. Ovaries were qualitatively assessed for ovarian follicle count of each stage of maturation. Perchlorate exposed mice had smaller Leydig cell nuclei and a higher proportion of vacuolation and disorganization in seminiferous tubules while ovarian follicle count increased for secondary, late antral and overall total. These data are consistent with findings from stickleback studies with the increase in ovarian maturity. These findings are concerning because mice are more closely related and a better model for what may be occurring in humans exposed to similar concentrations.

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The Effects of Steroid Hormones on Neurogenesis in the Breeding and Non-Breeding Green Anole Lizard (*Anolis carolinensis*)
Brooke Miles, Alex Calli-Wehrman

Neural plasticity, or changes to the brain over time, is an important area of study that may yield better treatment options for various neurodegenerative diseases. One aspect of neural plasticity is the addition of new neurons from neural progenitor cells, called neurogenesis. Brain regions such as the hippocampus, the olfactory bulb, and the amygdala are known to add new neurons in adults. It is also established that the structure and function of many brain areas depends on the levels of circulating steroid hormones, such as testosterone (T), estradiol (E2), and dihydrotestosterone (DHT). The present study aims to analyze the overall effects that these steroid hormones have on neurogenesis in the amygdala. We are studying the seasonally breeding green anole lizard (*Anolis carolinensis*) because these lizards exhibit seasonally dimorphic steroid hormone levels. Additionally, the green anole lizard amygdala, a region of the brain involved in reproduction, has more neurons in the non-breeding compared to the breeding season. We hypothesize that lizards treated with steroid hormones will have a lower number of new neurons in the amygdala. To address this, breeding male lizards were treated with T, E2, DHT, or blank capsules and injected with bromodeoxyuridine (BrdU), a compound that labels dividing cells. The brain was collected and an immunohistochemistry was performed on brain sections. The sections were double-labeled using antibodies for BrdU and NeuN (a neuronal maker), and DAPI as a cell nuclei marker. Currently, we are imaging tissue sections using a Zeiss LSM880 confocal microscope and examining images for double-labeled neurons in the amygdala to determine effects of steroid hormone treatment on new neuron numbers. Examining how steroid hormones impact neurogenesis will help increase understanding of plasticity in the brain.

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The Effects that Virtual Learning and the COVID-19 Pandemic have had on Nursing Students at Minnesota State University, Mankato
Rachel Rana, Kayla Walsh, Anita Khatri, Dikshya Thapa

This study will explore the relationship between nursing students' stress levels and their experiences with virtual learning during the COVID-19 pandemic during the spring semester of 2021. Roy's Adaptation model guides the understanding of how individuals adapt to and interact with a changing environment. The model fits in the research to assess how nursing students deal with a stressful environment. What is the relationship between nursing students' stress levels and their experiences with virtual learning during the pandemic? We hypothesize that there is a positive correlation between the number of hours spent in virtual learning activities and the level of stress among nursing students. The study uses a descriptive quantitative design. It will examine the relationship between the variables cross-sectionally, without assuming causality among variables. Nursing students are eligible to participate in the study if they were enrolled in the Nursing Program at Minnesota State University, Mankato during the spring of 2021. Participants will be invited to complete a survey aiming to understand their stress levels and the extent of their experiences with virtual learning during the pandemic. The questionnaire includes items about demographics, socioeconomic information, academic life, stress levels, self-efficacy, feelings of isolation, and the number of virtual learning hours during spring 2021. The anonymous research survey will be sent to eligible students through the nursing administration office. Statistical data analysis will show whether the hypothesis is supported or not. The study will yield findings that will enable the researchers to draw conclusions and understand the relationship between nursing students' stress levels and their experiences with virtual learning during the pandemic.

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The Impact of Communication Methods and Frequency on Young Adult Professional Engagement
Colleen Jackson

Communication is a core part of how people build and maintain relationships. In the recent years, how we communicate with one another has changed with the rise of technology and creation of various communication platforms. In recent years, the influence of COVID-19 pandemic has led to significant decreased levels of young adult engagement. The purpose of this study was to determine if communication preferences and frequencies could be used to influence higher levels among young adults. This study was conducted as an online survey which measured young adult engagement levels, communication preferences, and communication frequencies. The results of this study determined that communication platform preferences accounted for about 25% of work engagement and 23% of school engagement respectively, suggesting that a relationship between engagement and communication preferences exists. Additionally, the frequency of professional phone calls was also correlated with school engagement. This finding also suggests that while frequency of professional communication was not as strongly linked to engagement as communication preferences, frequency still likely does influence engagement under specific circumstances.

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The Influence of Covid-19 on College Students' Anxiety
Lauren Eckert, Whitney Sumihi, Ariana Jacobs, Annie Grund, Cooper Fuller, Kathleen Ristau, Peyton Primmer

COVID-19 is a public health crisis that has had an effect on every demographic group. College students are not only coping with the stress of school work, extra curriculars, and other factors but also COVID-19 which has had a sizeable effect on college-age individuals. At the start of the pandemic, a large number of college students were uprooted from their day to day lives and forced to move back home which caused loss of socialization among peers. There have been many serious lifestyle changes that have had to occur with the pandemic. Because of these changes, numbers have risen in anxiety and depression. As COVID-19 is still relevant in our world today, we felt it was important to attempt to understand the impact it has on the life of a college student, along with any impacts it may have on other aspects of life. Therefore, this study will be aiming to investigate how the COVID-19 pandemic has increased or decreased the levels of anxiety in college students via a survey measuring behaviors related to their academic and everyday lives. This can allow for a better understanding of current anxiety in students, which will make it easier to accommodate and communicate with students in these circumstances. We hope to assist in the growth of knowledge surrounding anxiety and the overall mental health impact of COVID-19 by surveying college-aged individuals on concepts unique to us, such as motivation levels, isolation, and anxiety levels associated with different methods of teaching. We hypothesize that the college students who have increased anxiety due to COVID-19 will also report lower motivation and less achievement in academics, compared to participants who did not appear to have increased anxiety. The analysis will aid us in understanding the relationship between anxiety and COVID-19 in current students at our university.

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Using genomic DNA of *Anolis carolinensis* to determine sex in juvenile lizards
Ashley Kraudy, Nadia Lowery

Steroid hormones, such as testosterone and estradiol, have important roles in vertebrate development by producing sex-specific structures, including the brain and copulatory system. Green anole lizards *(Anolis carolinensis*) take approximately 28 days to hatch after an egg is laid and uses the XY sex-determination system (similar to humans). Male anoles possess copulatory organs called hemipenes that are present in both embryonic male and females until embryonic day 10, when the hemipenes begin to regress in females. Previous work has shown that estradiol treatment during embryonic day 10 and 13 can cause the hemipenes to regress in male embryos. Although it is well established that estradiol masculinizes the rodent brain, little is known about how estradiol impacts brain development in lizards. Our overall goal is to examine the impact of estradiol on green anole brain development, using hemipene regression as a positive control for treatment. To complete this experiment, we must be able to determine the sex of each hatchling. Hatchling torsos were sectioned and stained with hematoxylin and eosin, then examined under the microscope to determine sex. However, it was difficult to determine which gonad was present in each hatchling, as the histology of testes and ovaries is very similar in juvenile lizards. Therefore, we have begun studies to isolate genomic DNA from hatchlings and determine the sex of each individual using PCR amplification of sex-specific genes. Once we have established this technique, we plan to continue examining the hemipenes and brain for effects of estradiol treatment. This study will help us determine whether estradiol is necessary to masculinize the anole brain, which will provide evidence for a role of estradiol in brain masculinization across vertebrates.

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Using genomic DNA of *Anolis carolinensis* to determine sex in juvenile lizards
Ashley Kraudy, Nadia Lowery

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Vekta Bracket Project
Samuel Day, Rachael Johnson, Yeng Moua, John Nutt

at Twin Cities Engineering Spring 2022, our team was assigned with redesigning a bracket for our client "Vekta". Vekta produces linear automated sawmills which have brackets holding delicate sensors. The brackets Vekta currently have can get impacted during the linear sawmills operation, but the brackets are sturdy enough to handle any and all typical forces. The problem is the brackets cost about $50-$70 per bracket. We successfully developed a prototype to replace the current bracket for only $24 while exceeding the strength of the original bracket.

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Virtual International Learning: Exploring Healthcare Similarities and Differences
Marisa Sullivan, Grace Omann

International learning experiences provide nursing students opportunity to expand knowledge of global health systems. Students participated in a weeklong program with peers from Austria, Greece, and Germany. The purpose of the international learning experience to compare and contrast cancer care and nursing practices offered in these countries. Students learned from expert lecturers from the United States, Switzerland, Austria, the United Kingdom, and the Netherlands on nurses' roles in cancer care, new advances in cancer knowledge, analyzing rituals/regular practices in nursing care, and using individual experience to inform and improve service provision. Students discussed cultural, social, and economic factors that impact cancer care and nursing rituals (practices). Groups were comprised of students with different experiences, knowledge, values, and skill sets to develop a case study and plan of action for a client. On the final day, students presented their case study and care plan during a student conference. Through discussion in diverse groups, students learned how healthcare systems compare. Findings included the United States healthcare system being the most complex compared to Austria's publicly funded system and Germany's solidarity community system. Through reflection, students identified future practices such as researching community resources for patients being discharged, the necessary focus on psychosocial aspects of care, implementation of collaborative skills, and communication through language barriers. Students learned to adjust workflow and interactions to ensure success for everyone in the group. The use of a virtual platform allowed accessible learning during a pandemic. Students grew personally and professionally through collaboration, increased cultural competence with communication, and expanded understanding of global healthcare delivery systems while gaining insight of shared values in nursing.

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Who needs an energy boost? Do differences in energetic requirements to perform a tail-flip jump cause differences in muscle composition?
Makenzie Reed

Fishes are generally considered to be fully aquatic, but some voluntarily strand themselves on land to escape poor water conditions, predators, or to exploit terrestrial niches. On land, many fishes move around using a tail-flip jump without apparent morphological specialization. I aimed to understand how small changes in morphology can affect the ability of a fish to perform a tailflip jump. Zebrafish (*Danio rerio*) pose as an excellent model to investigate this because these fish move around on land with a tail-flip jump and many varieties have been bred in the pet trade. In this experiment, I utilized wildtype and longfin zebrafish to determine if the longer fins affect the fish's ability to move on land. I hypothesized that longfin zebrafish will not be able to sustain jumping for the same duration as wildtype zebrafish because the longer fins will make the behavior more energetically expensive. Individuals of each strain were placed in an arena composed of a hard, rough surface and a damp substrate and filmed performing a tail-flip jump. Each fish was jumped multiple times and the best jump was used for kinematic analysis. Each fish was then placed in a three-foot plastic wading pool and filmed producing voluntary jumps for three minutes and then elicited to jump continuously until exhaustion. Individuals were euthanized, weighed, and photographed to measure the area of the caudal fins. Following this, each fish was fixed in formalin, embedded in wax, sectioned, stained, and analyzed for their relative proportions of red and white muscle. Differences in the two strains led to several differences in the voluntary and elicited jump trials, but not the individual jumps. These data imply that fin morphology may not have a large impact on single jump performances but may have an impact on sustainable jumping ability.

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Data Acquisition and Analysis of a Formula SAE Car
Benjamin Cacka, Alex Van Den Heuevel, Trevor Rowe

The purpose of this research project is to take data acquisition readings from a MoTeC brand data acquisition module and interpret the data relating to the performance of a formula SAE car. The process of this experiment will include test driving the vehicle in a controlled environment taking readings from numerous sensors placed on the vehicle. Some of the sensors used include linear potentiometers on the suspension, accelerometers, brake pressure sensors, wheel speed sensors, and infrared temperature sensors. There will be changes made such as raising and lowering tire pressures, adjusting tire camber, adjusting brake bias, and adjusting the stiffness of the springs on the suspension. All of these changes will be made with the car running on the same course to maintain consistency as well as making one change to the chassis at a time. A successful change will be noted as a decrease in lap time as well as a higher average lap speed. The challenges that will be faced are deeming whether or not the improvements of lap time were due to the change in the vehicles dynamics or if it was purely driver improvement. To combat this issue, there will be a combination of average lap time, as well as having multiple drivers do runs with each change. This will allow to improve accuracy and if the change in lap time is significant with all drivers, then the change can be solidified as an improvement.

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