

Bodies Having Been Changed: Gender Identity in Ovid's Metamorphoses and the Nonbinary Experience

Lindsey Kohlhasse '23

Advisor: Yurie Hong, Greek, Latin, and Classical Studies

Time: 4:00-5:00

The modern world has recently started embracing its diversity and allowing for women, disabled individuals, people of color, and LGBTQ+ individuals to provide their own insights about the ancient world. In this presentation, I provide my own interpretations of Publius Ovidius Naso's Metamorphoses, from the perspective of a nonbinary Classics student. I address what I think it means to be nonbinary, and how Ovid defines gender identity. I also review the themes of gender transformation and dysphoria in relation to transgender and nonbinary individuals by focusing on three stories and their relation to gender identity and queerness: Iphis and how compulsory heterosexuality impacts gender presentation, Hermaphroditus and the feelings of otherness associated with identifying outside the male/female dichotomy, and Io's feelings of dysphoria and the matching of physical identity to personal. By addressing what it means to be nonbinary, and how Ovid's Metamorphoses defines gender identity in regards to my own experiences, I am able to understand and provide a modern interpretation of gender performance in ancient Roman works while also using my own introspection into my gender experience as a way of inspiring other scholars to question the gender binary.

"If it's not on Strava it didn't happen": Perceived psychosocial implications of Strava use in collegiate club runners

Emma Nelson '22, Mackinzee Miest '22, Juan Burleigh '22, Megan King '23, Evelyn Villalobos '24

Advisors: Hayley Russell, Health and Exercise Science; Charlie Potts, Dean of Students Office

Time: 4:00-5:00

Since 2009, Strava has built a base of 50 million athletes who use the app to both record physical activity and connect with others using fitness tracking and social media functions. Our study aimed to determine the perceived psychological and social implications of Strava use, particularly in emerging adult recreational runners. We explored these perceived implications by conducting semi-structured interviews of 18 collegiate club runners who had been using Strava for at least 6 months. Participants were asked to share their thoughts, feelings, and behaviors associated with their use of Strava. Four main themes emerged: 1) social connection, 2) social pressure, 3) self-presentation, and 4) motivation. These findings demonstrate that runners perceived positive and negative aspects to their Strava use. Although runners felt supported and connected to other runners on Strava, some felt compelled to perform to a certain standard which could result in obligatory motives for exercise and overtraining. The results provide insight into

how this platform may be utilized as a tool for supporting runners' motivation, while also weighing the cost of the behavioral harms associated with use.

Real World Comparison of Sacrifice in Ancient Greece and Homeric Epics

Abby Yartz '23, Savanna Hanle '24, Adwoa Opoku Agyemang '25

Advisor: Seán Easton, Greek, Latin, and Classical Studies

Time: 4:00-5:00

In Homeric epic, sacrifices are an integral part, but what did these actions mean to the characters? As someone living in a society that does not perform ritual sacrifices regularly, modern-day readers may feel disconnected from the story. As readers, our perception of these sacrifices may be different than what happened in the past, possibly leading to inaccurate views of the plot and more importantly of history. Our project aimed to explore the purpose of sacrifice in the daily lives of ancient Greeks and to better understand why, how, and when these sacrifices were performed. More specifically we used a combination of modern and ancient sources to explore the truth of what sacrifices meant to the ancient Greeks. The audience of this project is not necessarily classics majors or experts in the field, but rather the general public who may be interested in seeing how their views of ancient sacrificial rituals compare to what real-life sources suggest happened.

Impact of Dual Relationships on Help-Seeking Beliefs across Rural, Suburban, and Urban Individuals

Callie Coleman '22

Advisor: Patrick Heath, Psychological Science

Time: 4:00 - 5:00

Dual relationships between clients and mental health practitioners are common in rural communities due to shortages of mental health practitioners. The extant literature has yet to examine how dual relationships might differentially impact help-seeking beliefs across community size. This gap in the literature is addressed by examining whether the presence of a dual relationship impacts help-seeking attitudes and intentions across rural, suburban, and urban individuals. Participants included students at a rural college ($n = 99$). Participants were randomly assigned to either a 'dual relationship' condition in which participants read short vignettes about a therapist with whom they had a dual relationship, or a 'non-dual relationship' condition in which there was no dual relationship present in the vignette, before completing questions about their attitudes and intentions towards seeking help from the therapist in the vignette. A MANCOVA examined the main effects of condition and community size on help-seeking beliefs. There was no main effect of condition but there was a main effect of location on attitudes, ($p <$

.05). Specifically, there was a significant difference ($p < .05$) between urban and suburban participants, and a near significant difference ($p = .057$) in attitudes between urban and rural participants. Results suggest that the presence of a dual relationship with a counselor may not impact help-seeking beliefs, but help-seeking attitudes differ across community size. Therefore, interventions to increase attitudes specifically aimed at suburban and rural communities may be important because negative attitudes can lead to avoidance of mental health services and a lower quality of life.

Ski7p-6His Purification by Affinity Chromatography: The Next Step for Co-purification of the Exosome Protein Complex in *Saccharomyces cerevisiae*

Julia Simms '22, Megan Zamow '22, Alyssa Paulson '22, Jadyn Surat '23
Advisors: Jeff Dahlseid; Janie Frandsen, Biochemistry & Molecular Biology
Time: 4:00 - 5:00

In order to use DNA to make working proteins in the cell, messenger RNA (mRNA) must first be transcribed from DNA. The rate at which RNAs are synthesized and degraded is important in determining the quantity and identity of proteins that will be created. Research on aberrant RNA decay has indicated that the cytoplasmic exosome, a multi-protein complex composed of 10 subunits, also degrades wild-type or normal mRNA. Determining which mRNAs are degraded by the exosome is crucial for understanding its role in regulating gene expression. The exosome-associated protein adapter Ski7p facilitates the association of RNAs with the exosome. In our research, we sought to capture Ski7p in order to co-purify the exosome complex components and, ultimately, the mRNAs that are being actively degraded by the exosome. A strain of *Saccharomyces cerevisiae* was genetically engineered to encode a truncated version of Ski7p with a string of six histidines incorporated onto the C-terminus as a tag (6-His). The Ski7p was successfully isolated using immobilized metal affinity purification, which bound to this tag because of the high affinity between the 6-His tag and nickel ions. We used both column chromatography and batch affinity purification and compared their effectiveness in purifying Ski7p and their potential for co-purifying other proteins in the exosome complex. Moving forward, co-purification of the entire Ski7p-exosome complex will allow us to determine which mRNAs are associated with the exosome. Through analysis of these co-purifications, the exosome's selectivity for mRNA degradation can be determined.

Investigation of Fumarase Protein Purification Through New *Saccharomyces cerevisiae* Constructs

Nick Aney '22, Anna McGeeney '23, Sydney Regalado '22, Matt Wichlen '22
Advisors: Jeff Dahlseid; Janie Frandsen, Biochemistry & Molecular Biology
Time: 4:00 - 5:00

The citric acid cycle is a key metabolic pathway that functions to generate the energy substrates required to sustain cellular life. The enzyme fumarase plays a vital role by catalyzing an essential reaction in this cycle. Fumarase is currently studied in the biochemistry laboratory curriculum at Gustavus as a model to learn about protein purification, and students purify a modified version of fumarase from *Saccharomyces cerevisiae*, also known as baker's yeast. Using an optimized purification protocol is critical to facilitating student learning of proper protein purification techniques—an essential skill in biochemical research. The fumarase protein currently used is modified to contain a histidine tag, which allows for selective binding and purification when using an affinity purification column. We compared the purification yields of this fumarase variant with another fumarase variant which contained an identical tag but was engineered to increase cytoplasmic fumarase expression. The previously established purification protocol was used to purify both variants. This involved growing and harvesting yeast cells, purifying fumarase through affinity chromatography, and conducting assays to determine total protein concentrations and fumarase activity. This allowed for the determination of the viability of the new variant for usage in the biochemistry laboratory. Preliminary results indicate that the new fumarase variant has a higher fold purity and yield than the currently used variant. We suggest switching to the new variant would result in more successful protein purifications and an enhanced student learning experience in the biochemistry laboratory.

The Purification of Hfq in *E. coli* through Chromatography and Dialysis to Understand sRNA and mRNA Interactions

Annie Corbett '23, Nicholas Dol '22, Abigail Paulson '22, Blake Power '23

Advisors: Jeff Dahlseid; Janie Frandsen, Biochemistry & Molecular Biology

Time: 4:00 - 5:00

Gene expression, the transfer of genetic information from DNA to RNA to a protein, is a highly regulated process that dictates the characteristics of an organism. Many of the regulatory mechanisms control messenger RNAs (mRNA), molecules that carry the genetic information coding for the synthesis of a protein. Hfq is a protein involved in a particular regulatory mechanism that facilitates the interactions between small non-coding RNAs (sRNAs) and mRNAs. These RNA-RNA interactions modulate gene expression by preventing protein production, influencing the ability of bacteria to adapt to stress and infect a host. Therefore, understanding the role of Hfq in sRNA-mRNA assembly is important for understanding the mechanism of gene regulation and its impact on physiology. We sought to optimize a purification protocol for Hfq that would be efficient and use equipment available at Gustavus. Here we present the use of affinity chromatography, a purification technique that selectively separates a sample based on binding interactions, to purify Hfq from *E. coli*. We grew cells engineered to express Hfq modified with a specific affinity tag and then separated and purified Hfq using the complementary affinity chromatography system. We have confirmed that our protocol provides a

method for producing significant quantities of Hfq and are moving forward to look into the functionality and binding interactions of Hfq. This work provides a starting point for further research, such as removing co-purified RNAs, and will help in studying the interactions between sRNAs and mRNAs in the Frandsen lab in the Gustavus Biochemistry program.

Love, Hate and Vengeance

Jacob Engdahl '23, Gena King '22, Chandra O'Brien '24

Advisor: Seán Easton, Greek, Latin, and Classical Studies

Time: 4:00 - 5:00

Love, Hate, and Vengeance is a project analyzing how the ancient Greeks perceived, represented, and comprehended extreme emotions mainly, as the title suggests, the varying forms of love, hate, and vengeance. Through a mix of primary and secondary sources, we have attempted to understand the myriad ways these feelings were both felt and represented. Two major sources for this project have been the Iliad and the Odyssey, both of them works of critical import to Greek culture, and both of which deal at length, and in various ways, with love, hate, and vengeance. We also explored Euripides' Bacchae and Hippolytus, as well as Plato's Symposium, all of which provided further lenses and perspectives to broaden our understanding. This research has been supported at each step by the work of various scholars, all which can be found in our bibliography. Ultimately, our hope is to provide our audience a greater level of understanding not just for how the ancient Greeks conceived of and understood their feelings and the world around them, but how that relates and informs how we understand our world today.

Quantifying Kinetochores Assembly by Electrophoretic Mobility Shift Assay (EMSA): This Shift's Crazy

Hanaa Alhosawi '22, Briana Hogstad '22, Meghan Sinn '22, Korinna Hylen '22

Advisors: Jeff Dahlseid; Janie Frandsen, Biochemistry & Molecular Biology

Time: 4:00 - 5:00

Centromeres are required for chromosomal DNA to be separated during cellular division, an essential biological process resulting in replication of cells. Centromeres are located within chromosomal DNA and are responsible for transmission of genetic information to daughter cells. The kinetochore is a complex of proteins and centromere DNA central to this process. Our research focuses on quantitatively measuring the kinetochore assembly in baker's yeast using an electrophoretic mobility shift assay (EMSA). EMSA is an important tool biochemists use to analyze interactions between DNA and proteins, or in our case, the centromere DNA and kinetochore proteins. To quantitatively investigate this interaction between centromeric DNA with kinetochore proteins, an internal control would be essential. Abf1p offers potential for use as this internal control. We discovered that adding a fluorescent tag to both strands of the DNA bound by Abf1p (from yeast) produced the best experimental signal for an internal control without interference when imaged at an 800 nm wavelength. We hope to be able to use this in

combination with the fluorescently-tagged centromeric DNA, which images at 700 nm wavelength, allowing for a robust quantitative analysis of the kinetochore DNA/protein assembly without complications of interference from the internal control.

Colleges, Context, and the Complications of the VAWA: An analysis on the intersections of contextual political ideology and VAWA complaints on college campuses.

Kelsey Walock '23

Advisor: Chris Gilbert, Political Science

Time: 4:00 - 5:00

A report of empirical analysis based on exploring the connections between college campuses with differing surrounding ideologies and violations and cases related to the Violence Against Women Act. Conducted research analyzes multiyear considerations of violations present in both public and private institutions to consider how ideology creates a college environment conducive to the implementation and education of assaults and relevant VAWA violations. Findings indicate desire for more research as well as some significant correlations.

The Duality of Helen

Bailey Wagner '24, Hari Halvorson '24, Hanna Lee '25

Advisor: Seán Easton, Greek, Latin, and Classical Studies

Time: 5:00-6:00

Helen of Troy, “the face that launched a thousand ships”, is a prevalent figure within media both ancient and modern, but her depictions vary greatly. Some authors portray her as an “angel of war”, playing a willing role, whilst others defend her, citing her loss of agency in the situation. This dichotomy between characterizations of Helen of Troy and her prevalence result in abundant examples of both the internal and external conflicts facing Helen, and how she copes with them. Our work is trying to take these contradictions and summarize them in an entertaining fashion, using both primary classic sources as well as secondary interpretations of Helen’s character.

Detection of dicamba in the gas phase using various sorption materials and GC-MS

Annika Silverberg '22, Elisabeth Kray '23

Advisor: Amanda Nienow, Chemistry

Time: 5:00 - 6:00

Dicamba is a chlorinated herbicide commonly used on corn, soybeans, and other commercial crops. Some farmers plant dicamba resistant soybeans to allow for the safe use of this herbicide, however dicamba is severely volatile, which allows it to drift into nearby non-resistant crops, causing irreversible damage. Because of this, it’s important to study the volatility of dicamba in the gas phase to further understand how it behaves after it’s applied to crops. This study used Gerstel Thin-Film Solid Phase Microextraction (TF-SPME), Twister, and SPME Fiber

technologies in the Agilent GC-MS (gas chromatograph-mass spectrometer) to optimize parameters for studying dicamba in the gas phase. It was found that TF-SPME and Twisters are optimal sorption materials for soil and leaf extractions, but SPME Fibers are more of interest for air sampling. SPME Fibers adsorb dicamba more efficiently after they have been pre-derivatized with BSTFA, a derivatization agent commonly used to limit steric hindrance of molecules while binding to sorption materials. The ultimate goal in this project is to use the optimized and optimal dicamba detection method to address the research question: “Are photodegradation and/or reaction with gas-phase oxidants changing dicamba on timescales relevant to vapor drift and volatilization?”

5:00 p.m. - 6:00 p.m.

Investigating the Relationships between Course Outcomes, Student Demographics, and Inclusive Teaching Practices in STEM Courses at Gustavus

Josephine Bierbaum '23, Anna Grotins '22, Cole Fischer '22

Advisor: Jillian Downey, Mathematics, Computer Science, and Statistics

Time: 5:00 - 6:00

Previous work has shown that in the United States, underrepresented minorities (URM) in science, technology, engineering, and mathematics (STEM) fields are less likely to complete an undergraduate STEM degree than their non-URM counterparts. While this is known, what is unknown is how to increase the number of URM students seeking undergraduate STEM degrees. The goal of this research was to investigate the relationships between course outcomes, student demographics, and inclusive teaching practices for 100 and 200-level STEM courses at Gustavus Adolphus college in an attempt to increase representation in STEM fields. We analyzed data collected from pre and post-semester surveys administered during the fall of 2021 semester. We began by investigating the survey completion rates for students and found that URM were less likely to complete the second survey given at the end of the semester. We also looked at the grade distributions within STEM courses and compared URM and non-URM students. There were no differences between URM and non-URM students for the median and seventy-fifth percentile of grades. However, we found that the twenty-fifth percentile of grades for URM was consistently lower than the twenty-fifth percentile of grades for non-URM. Additionally, we found evidence that inclusive teaching practices may mitigate the differences in grades between URM and non-URM in STEM.

Creative Escapes of War: The Mind and Conflict

Jorrun Kuehn '24, Emelia Laryea '24, Kekeli Kwawukume '24

Advisor: Seán Easton, Greek, Latin, and Classical Studies

Time: 5:00 - 6:00

Through exploration of Homeric Epic and various texts in peace, justice, and conflict studies, it becomes clear that from Ancient Greece to the modern day, people have been psychologically affected by the tragedies of war. From soldiers on the front lines to families escaping conflict, the realities of widespread violence, insecurity, and uncertainty have placed a heavy burden on all who undergo this experience. Our project looks to illustrate the external chaos of war alongside the equally tumultuous internal psychological experience of war. We focus on artistic expressions of the complex emotions present which include both comradeship and loneliness, pride and shame, hope and despair, and courage and fear. Art is a coping mechanism that many people use as a way to express and escape their new realities. Art can be displayed in many ways, and that is what makes it a unique form of expression because there is no right or wrong. We will display many different forms of art, and leave it to interpretation to viewers to understand the complexities of the minds of those affected. We encourage the audience to have their own perspective about the art pieces before revealing or giving the true background story behind them.

A Nation Haunted: The Ghosts of Francisco Franco and Spanish Horror Cinema

Celia Reece '24

Advisor: Ana Adams, Modern Languages, Literatures and Cultures

Time: 5:00-6:00

In 1975, after the fall of the 36 year dictatorship of Francisco Franco, the Spanish government passed a law known as the Pact of Forgetting. Though the law freed political prisoners and granted impunity to those who committed crimes during the war, it stood primarily as an idea: A hope that forgetting the trauma suffered under Franco would somehow help the nation heal. While the public and government turned away from the past in an attempt to move on from it, some filmmakers chose to face the issues, creating pieces of fictional terror to process the real horrors the nation had so recently escaped. From the designs of the monsters formed in the mind of Guillermo del Toro to the much more human monsters also displayed on screens, the marks of Franco's regime, and acts of rebellion against the things it stood for are found all throughout Spanish horror. In this paper, I examine the trends in Spanish horror in relation to the events the people of Spain experienced under Franco, and how horror films provide unique insight as to how a recovering society processes the ghosts in their past.

Redefining Marriage: A Comparative Analysis of Feminine Agency in Charlotte Brontë's Jane Eyre and Louisa May Alcott's Little Women

Austin Witt '22, Kelly Carlson '22

Advisor: Vera Foley, English

Time: 5:00-6:00

Nineteenth century social scrutiny of marital law produced a period of literary works attempting to undermine the gendered and social hierarchies of marriage. Charlotte Brontë's novel Jane Eyre

and Louisa May Alcott's novel *Little Women* redefine marriage by providing women with more opportunities of feminine agency. Brontë's protagonist, Jane, insists upon validating her own self-possession throughout her relationships in an attempt to achieve an equal partnership. *Jane Eyre* speaks on the oppression of women, on the importance of self-possession, and argues means of changing traditional ideologies of marriage. Meanwhile, Alcott intends to avoid all pressures of class and gender hierarchies to provide her 'little women' with her own rendition of marriage options. Focusing on Meg and Jo, Alcott aims to present more viable options for women to gain agency through marriage, largely emphasizing the practice and preparedness needed to manage the household. As nineteenth century authors, both Brontë and Alcott are invested in providing feminine readers with different pathways of achieving agency inside of marriage, effectively capturing an audience that questions the 'ideal' form of marital unions in order to envision a healthier version of conjugal love.

The Philosophy of Anger in a Classical Context

Jack Raway '24, Konrad Wernsing '25, Tristen O'Brien '24

Advisor: Seán Easton, Greek, Latin, and Classical Studies

Time: 5:00-6:00

This presentation will be about an artifact; in essence, about a dramatic performance that we have set to music. The presentation will portray our interpretation of the place of anger in Homeric works, but more specifically how that anger has been interpreted by ancient philosophers. Our presentation as a whole will be a combination of the performance and of an accompanying guide. The denial of anger as a viable emotion, and moreover the stance that anger is simply weakness of character will be examined and criticized, and the opposing argument that anger has moral circumstances shall have the same treatment. The goal of this presentation is to demonstrate the ideals of ancient philosophers on anger, then juxtapose that view with homeric style work that portrays violence and anger in a dramatic sense. This duality will provide the viewer both with a sense of the philosophical thought, and the source material that much of that thought comes from.

Expression, Isolation & Characterization of *S. pyogenes* Cas9 Endonuclease in *E. coli* Bacterial Cells

Caden Gunnarson '23, Eamonn McCullough '22, Ashleigh Metcalf '22, Timothy Whiteman '22

Advisors: Jeff Dahlseid; Janie Frandsen, Biochemistry & Molecular Biology

Time: 5:00 - 6:00

Cas9 is a DNA cutting enzyme (endonuclease) that was originally isolated from bacteria. Since its discovery, the ability of Cas9 to make targeted DNA cuts has led to many biotechnology applications, examples of which include use of precision gene editing in gene therapy, bioreactors, and biofuel production. At Gustavus, Cas9 is used extensively in the molecular genetics course, therefore, developing a protocol to produce Cas9 in-house rather than relying on

external vendors would save Gustavus time and money. One method to produce useful amounts of Cas9 is by growing bacteria engineered to produce large quantities of the enzyme, then harvesting Cas9 via protein purification methods such as affinity chromatography. Affinity chromatography is a lab technique that allows proteins expressed with a His-tag - a tail of usually six histidine amino acid residues - to bind to nickel ions in a column, separating them from other proteins. We transformed a competent strain of *E. coli* with the plasmid (loop of DNA) pET-28b-Cas9-His, which contains a modified *S. pyogenes* Cas9 gene. This plasmid encodes a His-tagged Cas9 and allows the production of Cas9 to be controlled by adding the chemical IPTG. The bacteria carrying the plasmid were selected with the antibiotic kanamycin, lysed, and Cas9 purified using His-tag affinity chromatography. The isolated proteins were characterized, and the results demonstrated that we successfully purified a Cas9-sized protein. The next step is to verify the function of Cas9 using a DNA cutting assay. These results provide a starting point for producing Cas9 at Gustavus.

The Impact of Caffeine on Stress, Sleep and Anxiety Levels in College Students

Kulle Hassan '22, Joel Hug '22

Advisor: Erica Roelofs, Health and Exercise Science

Time: 5:00 - 6:00

BACKGROUND: A large portion of students in college rely on caffeine to cope with stress and remain awake. Studies show that a higher consumption of caffeine may result in dependency in caffeine which can lead to a tolerance to its adverse effects. Studies have shown that caffeine can worsen as well as improve depression, insomnia and anxiety levels. **PURPOSE:** To evaluate the relationship between caffeine consumption and stress, anxiety, depression and sleep levels in college students. **METHODS:** (exact number, including mean and SD will be added later) undergraduate college students participated in this study. After data was collected, students were categorized into groups depending on how much caffeine they consumed (No caffeine, moderate, high). **STATISTICAL ANALYSIS:** Using self reported questionnaires and surveys, scatter plots, tables and figures were used to compare the three groups to see the correlation between caffeine intake and levels of stress and anxiety levels. Each group is then graphed with the individual's BAI and BDI scores and sleep levels.

Dynamic Vs. Static Warm-ups on Collegiate Soccer Athlete's Standing Vertical Jump and 40 Yard Dash

Nicholas Leach '22, Megan King '23

Advisor: Erica Roelofs, Health and Exercise Science

Time: 5:00 - 6:00

BACKGROUND: The warm-up is an essential part of pre-game sport preparations. Previous research reported that warm-ups were often recommended before exercise; however, little research has been conducted on which type of warm-up is best for sprinting and jumping. **PURPOSE:** To examine the effects of dynamic stretching (DS) and static stretching (SS) warm-ups on collegiate soccer players standing vertical jump (SVJ) and 40 yard dash (40YD). **METHODS:** 19 collegiate soccer players (9 males and 10 females) between the ages of 18 and 22 (Mean + SD; 19.95 + 1.268 y) participated in this crossover study. Participants performed a generalized warm-up, followed by a randomly assigned SS or DS warm-up. After the warm-ups, participants completed the SVJ test and 40YD. Two days after the first visit, participants completed their second testing visit with the opposite warm-up as the first visit. The SVJ test and 40YD were completed again. **STATISTICAL ANALYSIS:** A paired samples t-test was used to compare the effects of DS and SS on SVJ and 40YD. **RESULTS:** There was a significant difference between DS and SS for both best 40YD ($p = 0.049$) and average 40YD ($p = 0.023$); however, there was not a significant difference between DS and SS for SVJ ($p = 0.067$). **CONCLUSION:** DS resulted in improved 40YD times but did not improve SVJ. Initial results suggest that DS warm-ups should be used for athletes to maximize sprinting ability. Future research should examine the specific benefits of DS warm-ups in tests of endurance.

Predicting Injury Occurrence for Iron Casting Workers

Alexis Fleming '22, Ben Menke '22, Ben Schwartz '22

Advisor: Jillian Downey, Mathematics, Computer Science, and Statistics

Time: 5:00 - 6:00

Iron casting is still a relatively dangerous field for workers in the United States. The Bureau of Labor Statistics found that on average, iron foundries in the U.S. reported 7.3 nonfatal workplace injuries per one hundred workers in 2020. This is more than twice the average rate of injury reported in manufacturing sectors as a whole and 2.5 times the rate for all workers in the country. Thus, mitigating the risk of workplace injury should be a key objective for firms working in the iron foundry sector. There has been some research done on injury rates for construction and manufacturing workers in the past, but this study focuses solely on the field of iron casting and utilizes data from Dotson Iron Castings in Mankato, MN. Additionally, Dotson would like to better understand their workplace environment and how their employees' risk of injury can be reduced. Timecard data collected from 177 employees between the years 2019 and 2021 along with 150 reported injuries were analyzed. In order to determine how to best mitigate injury risk, machine learning and regression analysis on the Dotson data was used to identify factors that most prominently impact the probability that a worker could be injured. The ability to predict injury occurrence using demographic variables such as age, gender, job class, and months of service, along with shift classifications such as shift length, time of day, and task was examined. The results of this analysis will be used to provide insights and guidance to Dotson Iron Castings

on factors that influence future injuries and steps that can be taken to reduce workplace risk for the employees.

Investigating Student Participation and Performance in Calculus I Courses that Utilize Standards-Based Grading

Rachel Erickson '22, Ha Le '22, Kaylee Vick '23

Advisor: Jillian Downey, Mathematics, Computer Science, and Statistics

Time: 5:00 - 6:00

Standards-based grading does not rely on traditional methods of grading, but rather focuses on complete understanding of concepts deemed essential by the instructor. A student's grade depends on the number of standards the student meets where standards are graded pass/fail without partial credit. However, each student is given multiple chances to meet every standard. In this study, we analyzed student participation and success in a college-level calculus I course that utilized standards-based grading. By defining student "buy-in" as the level to which students participate in this class structure, we were able to use a clustering algorithm that revealed multiple groupings of students that were distinct based on activity throughout the semester. Additionally, we analyzed student progress, defined as the number of graded activities completed each week. We found that students who progressed steadily throughout the semester, and thus had lower variability in the number of completed activities per week, tended to receive a higher overall grade. Students whose progress was less consistent, and thus exhibited higher variability in weekly activities completed, tended to receive a lower grade. Overall, this shows implications for the pay-off of buying into the method of standards-based grading and succeeding in a course.

Bouncing Forward: Resiliency Course Intervention for College Students

Lindsey Westerberg '23, Annie Corbett '23

Advisor: Marie Walker, Psychological Science

Time: 5:00-6:00

Resilience can be thought of as the idea of bounce back, or even bounce forward, in the face of adversity. Every college student has the capacity to nurture their resilience and thrive in college. For the present study, resilience was measured by looking at emotion regulation, well-being, optimism, self-esteem, satisfaction with life, stress, and self compassion. Each year, students at Gustavus have the opportunity to take a class that teaches about resilience and skills to grow their capacity for resilience (Bouncing Forward: Resiliency Skills for College and Beyond, NDL-108). Students from this class were assessed for elements of resilience through a survey and their scores were compared to students taking a different January term class (e.g., psychology classes). Analysis of these data can help us learn more about the impact of resilience for students.

Does a Spoonful of Sugar Help the Paraquat go Down? Do Artificially Aged Mothers Produce Aged Eggs

Meghan Sinn '22

Advisor: Margaret Bloch-Qazi, Biology

Time: 5:00 - 6:00

In many types of animals, female reproductive productivity declines as they age. The common fruit fly, *Drosophila melanogaster*, can help identify common mechanisms of female reproductive senescence, because they share similarities with animals - including humans - at the cellular level. Females divide resources between maintaining body function and reproductive processes so additional stress to the body is predicted to result in decreased reproductive productivity. One type of damage, oxidative stress caused by mitochondrial senescence and disease states, also causes a decrease in reproductive fitness. However, it is unknown how well mothers can protect their eggs from oxidative stress. To study the relationship between stress and egg quality, young mothers were artificially aged with oxidative stress, and the protein content of their eggs were compared to mothers of the same chronological age. Their consumption of paraquat, an oxidative agent, was measured with the Capillary Feeder (CAFE) Assay and egg protein content with a DC assay. There was no difference in protein investment or protein content per oocyte between control flies and artificially aged flies, but there was a large difference in the amounts eaten. Paraquat-fed flies experienced high mortality.