

DU Undergraduate Showcase: Research, Scholarship, and Creative Works

PAGES AND PAWS: AN EXPLORATION OF THE BENEFITS OF MENTORSHIP BASED READING

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Our project focused on the poor literacy rates in the Denver metro area. Through extensive research with public organizations and nonprofits we learned that lower literacy rates are partly caused by children having low motivation to engage with books. To address this we partnered with the nonprofit Humane Colorado to bring students from the Denver Public School District into shelters to read to animals and engage in mentorship based reading projects. The increase of apathy surrounding literacy and reading, caused by a lack of engagement and structured education, is creating lower literacy rates and decreased motivation to read. Thus, we wanted to explore how to build an increased motivation to engage with reading and community. We conducted ten weeks of interviews and research, which we used to write a thesis on our findings and our plan to engage with local communities to improve reading engagement. Then, we reached out to various nonprofits such as Humane Colorado and Burning Through Pages to coordinate an event based in a local community where students from Denver Public Schools will participate in mentorship style reading engagement. Our project encouraged children to read, connected them with local communities, and provided them with avenues to continue their reading.

ECO-ENGAGEMENT THROUGH YOUTH PROGRAMMING IN THE NEXT GENERATION OF CLIMATE LEADERS

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As climate change becomes a topic requiring urgency and action, our group discovered that 1/3 of today's youth are considered "eco-disengaged," meaning they have low action, low awareness, and low concern for the issues facing our planet. Through our primary and secondary research, it was identified that students are wishing for more eco-involvement in terms of outdoor education and community members identified that there are gaps in Colorado's environmental education system. Given the need for more environmental awareness, our group strived to create a curriculum centered on engaging youth in age appropriate, climate related activities. Through hands-on mini labs, such as a sound safari and an urban heat walk, youth were able to connect to the changing climate and understand the significance of anthropogenic impacts. Youth learned basic ecology to connect the climate issue to the places they know and love. By delivering information to youth in an engaging and light hearted manner, the conversation of climate change can become educational and plant the seeds for the next generation of climate leaders. How can youth become knowledgeable and engaged in climate activism in an age appropriate yet effective way? This question is the culmination of many ideas shared through primary and secondary research, expressing the need for more climate awareness in youth to foster leadership moving forward. We met with key members of the climate and environmental science community, understanding how youth disengagement in climate activism has created an impact. Each meeting brought up the same idea, youth need hands on ways to learn about the risks our climate faces, leading to the creation of a curriculum and event centered around hands on environmental education. Our project met our goals of climate engagement as it created understanding and interest in the effects of climate change on the planet. Through mini labs, youth were able to enjoy the activity while learning how their actions have an effect on the environment.

"THREE IN A JEEP": EXPLORING THE CONDITIONS FOR SUCCESSFUL MANDATE ATTAINMENT IN UNITED NATIONS SPECIAL POLITICAL MISSIONS

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This thesis examines a specific type of United Nations peacekeeping operation, referred to as Special Political Missions (SPMs) and their progress in transitions from war to peace. While traditional peacekeeping has made advances in separating conflict and human rights development, SPMs provide concentrated specialization in areas, including electoral support, government mediation, and disarmament. Through a Structured Focus Comparison of three unique SPM case studies, this research explores what key dimensions are involved in successful Special Political Missions. By comparing the United Nations Mission in Nepal, United Nations Mission in Colombia, and United Nations Observer Mission in Bougainville, this thesis intends to learn why certain SPM missions complete their mission mandates and why others struggle to see progress. Under what conditions do United Nations Special Political Missions contribute to progress in transitions from war to peace? The following thesis utilized a Structured Focus Comparison to compare key dimensions between three distinct case studies. Each case was evaluated based on its completion of relevant factors in order to determine if the mandate was a success, partial success, partial failure, or failure. Ultimately, this thesis concludes that SPM outcomes are likely more successful when a mission has a positive relationship with the local host government and calls the UN to prioritize local stakeholder partnerships within their peacekeeping operations.

MOTHERS CHILDHOOD MALTREATMENT AND DEVELOPMENTALLY APPROPRIATE ATTRIBUTIONS OF 12 MONTH-OLD INFANTS

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By integrating knowledge on mothers' histories of childhood abuse and neglect, parental attributions of their 12-month-old infants, and their reflective functioning of infants, this research aims to understand how maternal childhood trauma influences early appraisals of infants' developmental capacities. Identifying and deterring links between childhood abuse and neglect and inappropriate expectations of one's own young children is an important step in breaking the cycle of maltreatment across generations. With the focus on developmentally appropriate expectations and parental reflective functioning, this study provides crucial insights into how mothers with trauma histories may interpret and respond to their children's needs. Findings aim to inform interventions to promote resilience and positive parenting behaviors. For instance, knowledge gained from this study could shape parenting programs that encourage parental attunement, warmth, and responsiveness. Overall, this research contributes to the broader effort to support parents and caregivers in creating nurturing and positive relationships with their children that promotes healthy development. This study examined associations between developmentally appropriate attributions (DAAs), a novel construct, with maternal childhood maltreatment and maternal reflective functioning (RF) with their 12-month-old infants. The study objectives were to examine if 1) DAAs were associated with parental reflective functioning at 12 months, and 2) higher levels of maternal maltreatment history were associated with lower DAAs. Participants were 156 mothers (40.0% White, 25.5% Latinx, 14.9% Black, 5.5% Asian, 2.1% Native-American, 12.0% biracial/multiracial) and their 12-to-15-month infants. Childhood maltreatment and RF were assessed by parental self-report at three-months and 12-months postpartum, respectively, and parental DAAs were assessed with the Five-Minute Speech Sample (FMSS) at 12 months, audio-recorded, and later coded by trained raters. Current findings revealed that while DAAs and RF were not significantly associated, maternal childhood maltreatment significantly predicted lower maternal DAAs of 12-month-old infants. Exploratory analyses showed that, of the childhood maltreatment subtypes, maternal history of childhood abuse, and particularly emotional abuse, predicted lower DAAs.

THE QUALITY OF EDUCATION: CONNECTING ACROSS DIFFERENT BACKGROUNDS

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Our team wants to advocate for the quality of education for students from immigrant backgrounds. Using our partnerships with ALG and Breakthrough we have created a training workshop. Breakthrough provides a pre-collegiate summer program for students from underrepresented backgrounds starting from 7th grade. For these summer programs, they hire teaching fellows which are usually undergraduate or graduate students pursuing a career in education. We are going to be presenting our training workshop on connection and empathy to these teaching fellows. Due to teaching fellows being of different backgrounds from their students, we want to make sure they still establish a connection with them and a mutual respect. We want to address cultural barriers and make the classroom a positive environment where there isn't tension between students and teaching fellows. How can we improve the quality of education for students from underrepresented backgrounds in our community in a sustainable way? We first found partners who knew more about the subject, we learned more about Breakthrough and ALG helped us with setting up our workshop. Since we were students who had cultural barriers with our own educators, we want to share that perspective with incoming educators, so they prioritize how they connect with students. Our workshop will be presented to teaching fellows of Breakthrough this summer, and it will also be presented to graduate students at DU before then. We are hoping this workshop speak to those who listen and will be hosted annually.

CARE FOR THE CAREGIVERS: STRENGTHENING DEMENTIA SUPPORT SYSTEMS

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With each team member having a personal connection to dementia, we decided to pursue the goal of helping somehow in this community. Through primary research, we have been in contact with many stakeholders in the dementia care community and have found that an area that can use more support is caretakers specifically. We have created connections at local assisted living communities to talk with staff, and these conversations have led to tangible ideas for change and improvements within support of caretakers both on a peer-to-peer and leadership-to-caretaker level. We are now working with families and leadership to implement these ideas to create sustainable change within these communities.

RESISTANCE AND CARE: TOOLS OF MOVEMENT BUILDING

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This poster details research conducted by the Documenting the Past Fostering the Future project, focused on spotlighting Chicano resistance and movements that flourished in Southern Colorado and Northern New Mexico. Through oral histories and exploring a community run newspaper, a rich and lesser-known history of El Movimiento/The Chicano Movement emerges from listening to voices often overlooked. What does El Movimiento mean across Colorado and New Mexico? Qualitative Research Methods, including oral histories and archival research. Our project has had the impact of creating a nuanced understanding of Chicano identity, struggles, and El Movimiento. While exploring both past community efforts and engaging in meaningful conversations with community elders today, this project has helped to bridge local history with an ongoing dialogue and understanding of identity and movement building.

THE STUDY OF THE COPATHOLOGY OF TAU AND α -SYNUCLEIN ASSOCIATED WITH LEWY BODY DEMENTIA

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My project focuses on understanding how two proteins, tau and α -synuclein, contribute to Lewy body dementia, a brain disorder that affects memory, movement, and behavior. I study how these proteins clump together on their own and when combined, and whether small molecules, called ligands, can influence this process. A central part of my work involves producing full-length tau protein, which is normally difficult to make in the lab. By

optimizing the production process, I was able to obtain enough high-quality tau to perform experiments that better reflect human disease. I then analyzed protein aggregation using biochemical assays to measure clumping under different conditions, including the presence of potential therapeutic ligands. This research helps reveal how tau and α -synuclein interact to drive neurodegeneration and provides insight into potential strategies to slow or prevent disease progression. My project addressed how tau and α -synuclein, two proteins linked to Lewy body dementia, interact and aggregate, and whether small molecules can influence this process. Understanding these interactions is important because they contribute to neurodegeneration and may reveal strategies to slow or prevent disease progression. I produced and purified full-length tau and α -synuclein proteins in *E. coli* and measured their concentrations for consistency. I then monitored protein aggregation over time using Thioflavin T fluorescence, comparing tau alone, α -synuclein alone, and a mixture of both, with and without potential therapeutic small molecules. I developed an optimized method for producing full-length tau protein, enabling more consistent experiments. Aggregation assays revealed a synergistic relationship between tau and α -synuclein: while each protein alone aggregated moderately, the mixture showed a rapid and significantly higher increase in Thioflavin T fluorescence over 120 hours, indicating that tau accelerates α -synuclein aggregation.

CYTOSKELETAL PROTEIN DYNAMICS IN ZEBRAFISH HEART REGENERATION

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Heart disease is one of the leading causes of death worldwide because the human heart has very little ability to repair itself after injury. In contrast, zebrafish can fully regenerate their hearts without forming scar tissue, making them an important model for studying how heart repair could be improved in humans. This project focuses on understanding how specific proteins behave during heart regeneration in zebrafish. I studied two proteins, VASP and Moesin, which help maintain cell structure and movement, to see how they change after heart injury. Using fluorescence imaging, we compared healthy hearts with hearts regenerating after injury. We found that Moesin increased in heart muscle cells during regeneration, suggesting it may play a role in rebuilding heart tissue. In contrast, VASP did not show significant changes. Additionally, neither protein showed major changes in blood vessels. These findings suggest that structural proteins like Moesin may be important for how heart cells reorganize and repair themselves after injury. Understanding these processes could help guide future research aimed at improving heart regeneration and developing new treatments for cardiovascular disease in humans.

USING MULTI-SENSOR SATELLITE IMAGERY TO DETECT AND TRACK TAMARISK INVASION ALONG RIPARIAN CORRIDORS IN THE SW UNITED STATES

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Tamarisk is an invasive shrub that has taken over riparian corridors across the southwestern United States, pushing out native plants and making restoration incredibly challenging. This study uses aerial and satellite imagery to detect tamarisk, depict its current distribution, and track its spread over the past two decades. Field measurements of tamarisk cover collected in 2024 at 10 sites across southern Utah and Colorado, along the Dolores River, San Miguel River, Salt Creek, and Colorado River corridors, were used to train a computer-based image classifier to identify three vegetation types: tamarisk, native riparian plants, and bare ground. Three different image sources were compared. NAIP aerial imagery at very high resolution (0.6 m), Sentinel-2 (10 m), and Landsat (30 m) to test which sensor best detects tamarisk from above. The classifier was then applied to past historical satellite imagery from 2000 onward to identify where tamarisk was newly established over time. Results suggest that the finest resolution imagery captures tamarisk most accurately, and that two decades of satellite data reveal clear patterns of spread and decline at treated sites. Overall, these explore how land managers and conservationists can use freely available satellite imagery to monitor the spread of invasive species, validate restoration outcomes, and prioritize future treatment areas across riparian ecosystems.

GENDERED JUSTICE: THE ROLE OF WOMEN'S CIVIL SOCIETY ORGANIZATIONS IN SHAPING CHILE'S TRUTH COMMISSIONS

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Scholarly literature has increasingly recognized that the inclusion of women and gender in formal transitional justice processes is essential for addressing the gendered nature of mass atrocities. This thesis seeks to contribute to the existing literature on how and why some transitional justice processes have come to address women and gender by specifically studying Chile's Rettig Commission and Valech Commission. Several hypotheses have emerged from the literature for why the Valech Commission addressed gender to a greater extent, including that women's civil society organizations, diffusion of international norms, and shifting domestic politics each played a role. Grounded in an anti-reductionist approach, this research utilizes the method of contribution analysis to strengthen and revise the theory that women's civil society organizations contributed to increased inclusion of women and gender in Chile's Valech Commission. The results of this analysis reveal that women's civil society organizations contributed on two levels: through formal collaboration and through public demonstration. By illuminating these strategies alongside inherent complexities and interactions in the case, this thesis contributes to a more nuanced understanding of how transitional justice processes come to address gender. Why do some formal transitional justice processes include women and address gender while others do not? Specifically in the case of Chile, why did the first truth commission (the Rettig Commission) not address gender, while the second truth commission (the Valech Commission did)? These questions are important for addressing the gendered nature of conflict and mass atrocity in the post-conflict setting. Grounded in an anti-reductionist approach, this research utilized a contribution analysis in order to better understand how women's civil society organizations contributed to Chile's Valech Commission addressing gender. In order to conduct the contribution analysis, where a theory of change is tested against new evidence, data was collected from primary source documents (newspaper articles, government documents and reports, organizational statements and documents, published interviews) accessed through digital, public archives in Chile in order to trace the processes of contributions made by women's civil society organizations. The results of this thesis advance new understandings of how women's civil society organizations contributed to greater inclusion of women and gender in Chile's Valech Commission, offering important implications for the broader field of gender and transitional justice. Beyond strengthening the initial theory of change, the findings of this contribution analysis offer critical revisions and nuances to the contribution story by demonstrating that women's civil society groups, through the processes of public demonstration and formal collaboration, contributed to the inclusion of women and gender in the Valech Commission.

ASSOCIATIONS BETWEEN MATERNAL FEEDING PRACTICES AND CHILD DIETARY PATTERNS: A COMBINED OBSERVATIONAL AND SELF-REPORT APPROACH

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This project explores how the way mothers encourage their children to eat in a lab setting relates to what those children eat in everyday life. We observed mother-child interactions during a structured eating activity, focusing on behaviors such as encouragement, pressure, use of rewards, and overall engagement, and then compared these observations to parent-reported information about the child's usual diet. By linking what parents actually do with what children typically eat, this study aims to identify which feeding strategies are associated with healthier eating patterns and provide practical insight for improving child nutrition. How do maternal feeding behaviors observed in a controlled laboratory setting predict real-world dietary patterns in young children? This question asks whether the ways mothers encourage or guide their children to eat in a controlled lab setting are linked to what those children actually eat in their daily lives. It aims to determine if observed feeding behaviors can help predict real-world dietary patterns in young children. This study examines whether mothers' feeding behaviors observed during a structured lab interaction are associated with their children's real-world dietary patterns. Observed behaviors were then compared to parent-reported data on children's usual diet using a standardized questionnaire. Regression analyses will examine how different maternal feeding behaviors (verbal prompts, physical prompts, bribery/negotiation, and engagement) are associated with children's intake of fruits, vegetables, added sugars, and processed snacks. These models will control for factors such as child age, sex, maternal age, and family income to better isolate the relationship between feeding behaviors and dietary patterns.

EMOTIONAL EATING IN EARLY CHILDHOOD: THE ROLES OF MATERNAL EDUCATION AND FOOD INSECURITY

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Emotional eating, or eating in response to negative emotions rather than physical hunger, is common in young children, yet its underlying predictors remain unclear. This study examined whether food insecurity (having limited reliable access to adequate, nutritious food) is related to emotional eating behavior in three-year-olds. Using data from the University of Denver's Care Project lab, we observed how children interacted with snacks following a brief frustration task and compared patterns across families with varying food security status and socioeconomic indicators, particularly maternal education level. Contrary to the hypothesis, food insecurity was not a significant predictor of children's emotional eating behavior in this setting. Instead, maternal education level showed a more consistent association with children's emotional eating behavior, with higher education levels linked to greater engagement with food. These findings suggest that early eating behaviors may be shaped by broader family and environmental factors beyond food access alone. While emotional eating is common in young children, less is known about its socioeconomic predictors. This study examined whether food insecurity and maternal education are associated with emotional eating behavior in early childhood, given the importance of understanding how early environments shape children's eating and emotion regulation. We analyzed data from the Care Project study, in which three-year-olds completed a brief frustration task and then were given access to snacks, allowing us to observe how they interacted with food. Using statistical models, we examined whether family food insecurity and maternal education were associated with children's eating behavior, while accounting for other factors, such as child sex. Contrary to our hypothesis, food insecurity status did not significantly predict either the total number of eating events or total duration of food engagement in response to frustration. Instead, maternal education emerged as a significant predictor of both outcomes, with children whose mothers had higher levels of education demonstrating greater engagement with food.

ELECTROPORATION PARAMETER ANALYSIS TO ESTABLISH TRANSGENIC METHODS IN A FRESHWATER SPONGE

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Currently, investigating the origins of multicellularity in Metazoans is currently limited by the lack of genomic tools and model systems. As one of the earliest diverging animal lineages, Sponges (Porifera) are an ideal system for this field; however, there is a gap in sponge research resulting in few genomic databases and genetic tools. Recently, developments in genomic databases and cell-type specific markers have allowed for starting a larger project for establishing transgenic methods in freshwater sponges. The first step of this project is to improve efficiency of the recent discovery in electroporation tools. The goal of this research is to test electroporation parameters in the freshwater sponge *Ephydatia muelleri* to improve the efficiency of transgenesis in sponges; I aim to study the molecular biology of animal cell differentiation by developing a high-efficiency electroporation protocol as the first step of a broader project into the genetic basis of multicellularity. The project focused on developing and increasing efficiency of transgenic methods in freshwater sponges. We are testing the uptake and expression of foreign mRNA injected and electroporated in sponges. We designed plasmids to test their efficiency for injections and electroporation. These use fluorescent marker colocalization and nanoluciferase assays in plasmids to quantify levels of expression. Preliminary data before the research confirmed that electroporation was possible in *E. muelleri*. Throughout the project, efficiency was significantly increased through investigation into parameters and plasmid design. mRNA expression in sponge cells increased by 900% in Nanoluciferase assays and we are continuing to research injections with dual expression plasmid DNA with fluorescent markers.

GRANT RESEARCH AND PROPOSAL DEVELOPMENT FOR COMMUNITY-BASED CLIMATE ACTION AT ANCA

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My project is part of my internship with Accelerate Neighborhood Climate Action (ANCA), a Denver-based organization that supports climate action at the neighborhood level. This quarter, I have been focusing on grant research and proposal support to help the organization identify funding opportunities that align with its mission and current priorities. The goal of this work is to strengthen ANCA's ability to secure resources that can support its programs, partnerships, and future community-based climate initiatives. My project asks how a community-based climate organization can identify and pursue grant opportunities that match its mission, current priorities, and capacity. This question is important because grant funding can directly affect whether ANCA is able to sustain and expand its neighborhood-level climate work. I supported the project by researching grant opportunities, reviewing ANCA's goals and funding needs, and helping shape proposal language around the strongest options. I also worked on the grant-writing side by organizing information, thinking through budget and resource constraints, and helping frame a clear, logical, data-backed proposal that made a realistic case for funding. The project is still in progress, but its impact so far has been helping ANCA move from general funding needs to more structured, realistic grant opportunities supported by organized research, budget thinking, and clearer proposal framing. By helping shape data-backed proposals around the organization's priorities and constraints, my work has supported ANCA's ability to pursue funding in a way that is more strategic, credible, and actionable.

BUILDING TOGETHER: UNDERSTANDING RECRUITMENT CHALLENGES AND SOLUTIONS FOR A HOME HEALTHCARE CO-OP

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This project sought to understand what is needed to create a home healthcare cooperative (co-op) which will give workers like Certified Nursing Assistants (CNAs) a work environment run for and by other workers. Recruitment is one of the obstacles in creating a successful co-op, leading this project to focus on recruitment challenges and solutions for the Wezesha Dada Center (WDC) to overcome, helping the WDC determine recruitment in order to work along side other organizations to aid in the formation of a home healthcare co-op. What challenges and solutions exist when attempting to recruit for a home healthcare cooperative? This project used different preexisting information to understand and estimate some of the challenges and costs for recruiting for a home health care co-op. This project will help deepen The Wezesha Dada Center's understanding and ability to recruit for a home healthcare co-op.

CLIMATE AND MICROSITE INFLUENCES ON TREE SEEDLING RECRUITMENT AT THE MIXED CONIFER-SUBALPINE FOREST ECOTONE

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Climate change is threatening forests in the Rocky Mountains, where temperature and precipitation play a major role in tree regeneration. Increasingly hot and dry conditions may be causing widespread failures in seed germination and seedling survival. In addition, fine-scale variation in things like soil moisture, light availability, and soil temperature can interact with climate to shape regeneration patterns. By tracking first-year germination and survival, this project evaluated how these environmental factors influence the regeneration of six conifer species in the Rockies. This study investigated how variation in climate and microsite conditions influences tree regeneration. This is vital to understand, as first-year recruits are the most vulnerable life stage in a changing climate. We sowed the seeds of six conifer species across a range of microsites in a forest at the mixed conifer and subalpine forest ecotone and followed germination and first growing-season survival for two years. We quantified soil moisture, understory light, and soil surface temperature in each quadrat and used climate data to compare conditions in study years with historic and recent means. Higher germination and survival in 2019 were associated with a wetter and cooler climate, and higher soil moisture also positively influenced germination. Our results show that while variation in microsite conditions can provide microrefugia for regeneration, climate conditions appear to be the overriding factor behind first-year recruitment success.

PERSPECTIVE OF PROFESSIONALS IN ADDICTION-RELATED FIELDS REGARDING LABYRINTH WALKING FOR INDIVIDUALS IN ADDICTION RECOVERY

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My goal was to understand how labyrinth walking might play a role in addiction recovery and to identify research questions of interest to professionals in the area. Based on a review of the literature on meditation, labyrinth walking, and addiction recovery, I conducted five informational interviews of professionals working in addiction-related fields. Professionals were recruited through convenience and referral sampling. Four were conducted over Zoom and recorded using its built-in feature. One was conducted in person and recorded on a mobile device. Interviews ranged from 10 to 45 minutes. Interviews included 17 questions exploring insights on labyrinth walking as a supportive practice in addiction recovery, with a follow-up question based on their response to a previous question. All interviewees viewed labyrinth walking as a potentially helpful tool in the recovery process, and most hypothesized that those earlier in recovery would benefit more from this practice. Some interviewees mentioned that there can be challenges with engaging in seated meditation for individuals in recovery, such as sitting still. Interviewees indicated that meditation can be beneficial for those in recovery, because it fosters mindfulness and reduces impulsivity. I am using the literature review and interview information to work with a community partner to develop a research study to investigate whether labyrinth walking increases certain contributors to addiction recovery and/or enhances them more than seated meditation does. These contributors to recovery include hope, reflection, self-awareness, spiritual connectedness, and perceived social support. Do professionals in addiction-related fields think that labyrinth walking might be helpful for individuals in addiction recovery, and what questions would they have about it? What are the most important practices and factors that benefit individuals in recovery? I conducted informational interviews with five professionals working in addiction-related fields, asking them questions I developed after a review of the literature on meditation, labyrinth walking, and addiction recovery. I selected these professionals through convenience and referral sampling, invited them to meet through email, and organized their responses based on the recorded interviews. All the individuals I conducted informational interviews with expressed that they thought labyrinth walking could be helpful for individuals in addiction recovery, specifically, because those in recovery struggle to sit still during meditation. The project met its goals by identifying key considerations for future implementation when working with a community partner, FREE Recovery Community, on developing a research study investigating the effects of labyrinth walking on individuals in addiction recovery.

REGULATING THE TROUBLED TEEN INDUSTRY: AN ANALYSIS OF UTAH'S LICENSING SYSTEM

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This project seeks to understand the role of the Utah Office of Licensing in regulating and preventing harm in the troubled teen industry, which consists of private, for-profit behavior modification and residential treatment facilities. It provides insight into the regulation of the troubled teen industry by analyzing records from the Utah Office of Licensing, which include incidents of abuse, neglect, and other harmful treatment of adolescents in residential care. This study aims to add to discussions about regulatory structures, child safeguarding, and the responsible use of government funds in adolescent mental health care. The purpose of this study is to better understand the role of the Utah Office of Licensing in preventing child abuse in for-profit residential facilities by identifying common violations observed by the Utah Office of Licensing and the consequences given to violators. This will give insight into how states can build effective oversight frameworks to prevent child abuse in the troubled teen industry. This study analyzed records of ten for-profit adolescent mental health facilities from the Utah Office of Licensing, including inspections, restraint and seclusion records, and reports of abuse to identify themes in violations identified by the Utah Office of Licensing, penalties for violations, and facility responses to sanctions. Beyond a thematic analysis, this study also tracked patterns in the types of incidents reported to the Utah Office of Licensing. While this project is still in progress, preliminary results show several weaknesses in Utah's regulation of the troubled teen industry. Ultimately, these results will promote the public good by providing recommendations for how state regulatory agencies can better protect the rights of youth in residential treatment centers.

GOAL AND INCENTIVE PRESSURES HAVE DIFFERENT EFFECTS ON RISKY DECISION-MAKING

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The notion of pressure is intuitive, yet it is still unclear how different kinds of pressure systematically affect different dimensions of decision-making. For example, sometimes pressure arises from the difficulty of one's goals. Alternatively, pressure can arise when there is much at stake, regardless of how difficult the goal is to achieve. Previous studies have investigated the impacts of goals and stakes on decision-making independently, but their potential interaction has not been examined. Similarly, decision-making behavior may be affected on dimensions including the choices made, the process of making those choices, and the affective experience of doing so, though most previous research has only focused on choice performance. In this thesis, we specifically examined the impact of two forms of pressure: 1) goal pressure, defined as the difficulty level of a goal, and 2) incentive pressure, defined as the bonus at stake if a goal is achieved. We examined these in the context of a risky decision-making laboratory task completed by 66 participants. In each of 4 blocks participants were instructed to attempt to reach a particular level of earnings in that block, and if they did so, they earned a monetary bonus. In addition to a subject fee, participants were paid their actual earnings (including bonuses) scaled by a scaling factor, making all choices, goals, and bonuses consequential. Each block was associated with a different and independently varying combination of goal (low vs. high earnings) and incentive (low vs. high bonus) pressures. We analyzed risky vs. safe choices, decision times as an index of cognitive effort and process, and skin conductance as an indicator of affect. We found separable impacts of goal and incentive pressures on decision-making. As expected, low goal pressure (i.e. an easy-to-reach earnings goal) increased goal achievement, and participants learned to achieve low goals more often over time in the study. We also found a reliable pattern of changes in risk-taking as a function of goal achievement. Participants were more conservative and slower to decide just before surpassing a goal, after which risk-taking and decision speed significantly increased. Incentive pressure, however, had little effect on choices, only impacting expected earnings, which may have influenced decision optimization. These findings suggest that goal but not incentive pressure, is a primary driver of adaptive changes in risky decision-making. How does pressure from the difficulty of achieving a goal versus the stakes of doing so differentially or interactively affect risky decision-making, the cognitive processes underlying evaluation and choice, and people's affective experience? We used a risky decision-making task that required people to navigate uncertainty while manipulating the goal earnings people were asked to reach, and the bonuses they could receive for doing so, to create a compounding pressure environment. We also assessed individual differences to see if specific attributes, like anxiety, goal attitudes, etc., might influence how people coped or responded to the imposed pressures. In our sample, we found that people change their behavior much more in response to differing levels of goal pressure (the earnings level to reach), and showed few effects of incentive (bonus amount) pressure in their choices. These findings highlight the critical importance of separating different potential components of pressure alongside different aspects of decision-making, and more broadly emphasize the importance of goals in dramatically altering behavior and ultimately performance.

INCLUDE OR EXCLUDE: THE ROLE OF GENDER DIVERSITY IN GROUP NORM JUDGMENTS

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Humans are highly attuned to group norms; however, judgements of what is normative can be biased by the behaviors of those that deviate from the norm (i.e., outliers). While prior research shows that behavioral outliers can shift judgments of norms, it is unknown whether this effect depends on social identity. In the current study, I examine how the behavior of individuals with stigmatized identities can influence norm assessments. That is, I investigate if the social behavior of a transgender individual is excluded from group norm judgements. Participants (N = 250) viewed individuals arriving to a teleconference co-working session, with their arrival time highlighted. The group included one time-based outlier which varied by gender identity (cisgender, transgender). Two findings offer initial evidence that participants encoded the trans employee's lateness but did not incorporate it significantly into their norm beliefs. Together, the results aim to clarify the relationship between behavioral outliers, norm judgements and gender, with a focus on how biased group perception can contribute to the exclusion of marginalized groups.

THE CASE FOR SANCTUARY: WHY DENVER, AND EVERY CITY, SHOULD ADOPT PROTECTIVE POLICIES

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Sanctuary policies limit how much local law enforcement cooperates with federal immigration authorities, which can shape trust, public safety, and access to essential services. Through an analysis of existing research and policies in other cities, this project evaluates the legal, economic, and human consequences of adopting sanctuary protections. It argues that sanctuary policies can strengthen community safety and stability by allowing immigrant residents to engage more fully in public life without fear. Ultimately, this work presents a case in favor of sanctuary policies as a practical and ethical approach to local governance. This project examines the role that sanctuary cities play in response to immigration enforcement practices, and the benefits of adopting these practices for both immigrant and non-immigrant communities. The question matters because local policy decisions directly shape the safety, economic stability, and civil rights of these communities, regardless of their citizenship status. This project uses a qualitative literature review of legal scholarship, policy analyses, and case studies of existing sanctuary jurisdictions. It also incorporates local context by examining Denver's current policies and comparing them to established sanctuary models in official sanctuary cities like Chicago and San Diego. The findings suggest that sanctuary policies are associated with improved public safety outcomes, stronger community trust in local institutions, and increased stability. This project contributes an argument for adopting sanctuary protections in Denver and beyond as a means of advancing human rights and the public good.

INVESTIGATING OPTICAL ANALOGUES OF COSMOLOGICAL PERTURBATION DYNAMICS

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This project investigates the possibility of constructing optical analogues of cosmological perturbation dynamics during inflation by exploiting structural similarities between the governing equations of each system. In particular, we analyze the correspondence between the Mukhanov–Sasaki equation for gauge-invariant scalar perturbations and the paraxial wave equation describing the evolution of coherent electromagnetic fields. Both systems can be written as second-order differential equations with time- or propagation-dependent effective potentials, suggesting a formal mapping between cosmological mode evolution and optical beam propagation. Within this framework, conformal time in the cosmological system is associated with longitudinal propagation distance in an optical medium, allowing the evolution of perturbation modes to be interpreted in terms of the transformation of optical field envelopes. We examine how key features of inflationary dynamics—such as mode amplification, horizon crossing, and freeze-out—can be recast in terms of beam evolution, with quantities like the Rayleigh range providing a potential analogue to the cosmological horizon scale. Using Gaussian beam optics and ABCD matrix formalism, we study how sequences of optical elements or engineered refractive index profiles can generate effective potentials analogous to those appearing in the Mukhanov–Sasaki equation. This work is primarily theoretical and aims to delineate both the possibilities and limitations of such analogies. Ongoing efforts focus on determining whether specific inflationary scenarios—such as slow-roll or non-standard models—can be meaningfully approximated within experimentally accessible optical configurations, and on clarifying which features of cosmological perturbation theory can be faithfully represented in a laboratory setting.

AFFORDABLE AIR QUALITY SENSORS: PROMISING TECHNOLOGY OR INSUFFICIENT SCIENCE?

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Air pollution from aerosols and their precursors remains a pressing global health and environmental issue, with significant regional variation. Locally, Denver continues to experience some of the worst air quality in the continental United States, consistently ranking among the top 10 worst regions for ground-level ozone pollution. This project addresses the need for affordable, accessible air quality monitoring tools by evaluating the performance of BlueSky's low-cost ambient aerosol and gas sensors. Low-cost electrochemical sensors, like the BlueSky by TSI, have emerged as an affordable alternative. This project evaluated whether these sensors are accurate and reliable enough to serve as legitimate scientific instruments, using Colorado as the study area due to its notable

air quality challenges. BlueSky sensor readings were compared with a reference-grade state monitoring station, and statistical models were used to test whether environmental factors such as temperature and humidity could explain measurement errors. The results showed that while these sensors can broadly detect whether air quality is good or bad on a given day, their errors were too large, inconsistent, and unexplainable to meet the standards of scientific research. Both the promise and the current limitations of affordable air monitoring technology highlight the importance of rigorously testing research instruments. Low-cost electrochemical sensors are increasingly marketed as accessible tools for monitoring air pollutants like ozone and nitrogen dioxide, but whether they meet the standards required for meaningful scientific research remains unclear. This project examined the accuracy and reliability of the BlueSky by TSI sensor in Colorado to determine whether affordable air monitoring technology can serve as a legitimate research instrument. Three BlueSky sensor readings of ozone and NO₂ were co-located and compared with a reference-grade monitoring station operated by the Colorado Department of Public Health and Environment (CDPHE). Statistical regression models in SPSS and Igor Pro were used to evaluate how well the sensors tracked true pollutant levels and whether environmental factors, such as temperature and humidity, could explain measurement errors. While the low-cost electrochemical BlueSky sensors could broadly detect highs and lows in pollution, analysis showed they lacked the precision required for scientific research. The errors found in the sensor data were largely unexplained and inconsistent, suggesting that, as low-cost electrochemical technology, it is not a reliable substitute for professional-grade instrumentation in research contexts.

OPTIMIZING AERODYNAMICS RELATED TO LONG ENDURANCE AND STATION-KEEPING HIGH-ALTITUDE AIRSHIPS

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High-altitude airships, generally operating at altitudes of around 20 km, are used for telecommunications and remote sensing applications. This research focuses on improving the endurance of these airships by reducing drag forces, which directly impacts energy consumption. Using computational fluid dynamics through Ansys Fluent, this study will analyze drag forces on different airship geometries over White Sands, NM in the winter. Simulations will consider three wind speeds, representing typical wind conditions during winter months, to assess maximum drag forces. Initial simulations will evaluate a predefined airship shape before exploring modified geometries. This research found that increasing the leading length of the airship reduces the drag coefficient and increasing the diameter increases the drag coefficient. One strategy for improving the endurance of high-altitude airships is to reduce energy consumption, particularly by minimizing the drag caused by wind resistance. This project will focus on this idea by exploring how different airship shapes affect drag forces. I altered the diameter and leading length of a standard airship geometry to create various models, which were tested with computation fluid dynamics simulations in Ansys Fluent. Increasing the leading length was found to reduce drag coefficients and increasing the diameter resulted in increased drag coefficients. These relations demonstrate how geometric modifications directly influence drag and provide guidelines for designing high-altitude airships with more endurance.

PLANTS BRIDGING PEOPLE: SURPRISE VALLEY INDIGENOUS TRADITIONAL ECOLOGICAL KNOWLEDGE FIELD DAYS

Halcyon Levi¹, Nicole Herzog², Fort Bidwell Indian Community, including Gidútikäd Band of the Northern Paiute community members and cultural leaders in Fort Bidwell, California³, Meldrick, One Horse Meza³

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Plants Bridging People: Surprise Valley Indigenous Traditional Ecological Knowledge Field Days brings together tribal members from the Gidútikäd Band of the Northern Paiute, local community partners, land managers, and university researchers to focus on First Foods, especially yapa, a culturally important root plant. The project looks at how traditional practices like harvesting and cultural burning affect the health and growth of yapa, while also creating space for knowledge sharing between elders, youth, researchers, and the wider community. My own contributions have centered on community engagement, youth-oriented educational materials, and helping communicate the importance of this work in accessible ways. The project goes further than plant data alone, it focuses on relationship building, cultural continuity, and supporting Indigenous knowledge in conversations about land stewardship and public land management. Can community engaged and collaborative anthropological

practices lead to positive outcomes for Indigenous communities in terms of advocating for greater sovereignty in management of resources on ancestral lands? This project utilized community-based workshops, field days, plant monitoring, harvesting activities, and collaboration with tribal members, elders, researchers, and land managers. This project helped strengthen relationships between tribal community members, researchers, and public land managers while supporting the sharing of knowledge across generations. It also contributed to ongoing research on yapa and helped create educational and community-facing materials that make this work more accessible, especially for youth and families.

THE NEUROPROTECTIVE EFFECT OF CDC42 INHIBITION IN THE G93A MUTANT HSOD1 MOUSE MODEL OF ALS

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Amyotrophic lateral sclerosis (ALS) is a progressive and fatal neurodegenerative disease characterized by the selective loss of upper and lower motor neurons, leading to muscle weakness, neuromuscular junction (NMJ) degeneration, paralysis, and eventual death due to respiratory failure. Despite extensive research, effective disease-modifying therapies remain limited, underscoring the need to identify novel molecular targets involved in ALS pathogenesis. Dysregulation of Rho family GTPases has been implicated in neurodegeneration, with Rac and Rho exerting opposing effects on neuronal survival; however, the role of the closely related GTPase Cdc42 remains poorly understood in ALS. In this study, the therapeutic potential of inhibiting Cdc42 was evaluated using ZCL367, a small molecule Cdc42 inhibitor, in the G93A mutant hSOD1 (hSOD1^{G93A}) mouse model of ALS. Treatment was initiated at disease onset and continued until end-stage. Disease progression was assessed through survival analysis, longitudinal behavioral testing of motor strength and coordination using paw grip endurance and rotarod assays, and postmortem histological analysis of NMJs in the gastrocnemius muscle. ZCL367 treatment did not significantly extend survival; however, treated mice exhibited significant preservation of muscle strength, coordination, and endurance compared to untreated and vehicle-treated controls. Additionally, ZCL367-treated mice showed a significant preservation of NMJ size and structural complexity, despite no significant effect on gastrocnemius muscle weight. These findings suggest that Cdc42 inhibition can preserve neuromuscular structure and motor function in ALS, even in the absence of prolonged survival, and identify Cdc42 as a novel contributor to ALS pathogenesis and a promising therapeutic target for slowing functional decline.

This study investigates whether pharmacological inhibition of the small GTPase Cdc42 using the compound ZCL367 can mitigate disease progression in ALS by preserving neuromuscular junction integrity and motor function in a mutant hSOD1 mouse model. More broadly, it asks whether targeting Cdc42 represents a viable therapeutic strategy for slowing functional decline in ALS, even in the absence of extended survival. We treated hSOD1^{G93A} mutant mice with the Cdc42 inhibitor ZCL367 beginning at disease onset and monitored disease progression through behavioral assays (paw grip endurance and rotarod), survival analysis, and postmortem histological evaluation of neuromuscular junction structure. These outcomes were compared to untreated and vehicle-treated controls to assess the therapeutic effect of Cdc42 inhibition. ZCL367 treatment did not significantly extend survival in the hSOD1^{G93A} mouse model, but it led to a significant preservation of motor function, strength, and neuromuscular junction structure compared to controls. These findings suggest that Cdc42 inhibition may slow functional decline in ALS and represents a promising therapeutic target despite not altering overall lifespan.

CRISPR-BASED MULTI-GENE EDITING IN YEAST FOR STUDYING PROTEIN DEGRADATION PATHWAYS

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This project focuses on improving gene editing in yeast, a simple eukaryotic organism widely used to study cellular function. Current methods are relatively inefficient, especially when modifying multiple genes at once. To address this, we developed a CRISPR-based system that can precisely edit several genes simultaneously without relying on traditional selection markers. This approach makes genetic research faster and more scalable, helping scientists better understand processes like protein breakdown and related diseases. Cells must continuously break down damaged or unnecessary proteins to stay healthy, but the genes involved in this process are not fully understood. This project asks how we can improve genetic editing tools in yeast to efficiently study multiple genes

at once, enabling deeper insight into these essential cellular pathways. We engineered a CRISPR-Cas9 system by designing guide RNAs through PCR and assembling custom plasmids capable of targeting multiple genes simultaneously. These plasmids were introduced into yeast cells to evaluate editing efficiency, accuracy, and the ability to perform markerless genetic modifications. This project demonstrates a more efficient and flexible method for editing multiple genes in yeast, especially in cases where traditional approaches fail due to limited selection markers. By enabling simultaneous, marker-independent edits, this system expands the ability to study complex genetic interactions and provide a scalable tool for investigating protein degradation and disease-related processes.

RESEARCH INTO URBAN FORESTRY EMPLOYMENT TREND IN COLORADO

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The Park People has a paid pre-apprenticeship program called TreeForce dedicated to educating people on tree care to prepare them for careers across the industry of urban forestry. My project was to assist this program by conducting research into industry needs, hiring positions, and seasonal trends so that the program can continue to adequately prepare its apprentices for an ever-changing industry landscape. What does the current landscape for urban forestry employment look like season-by-season, and how can TreeForce use this information to best equip its apprentices for careers in this field? 1. Receive guidance from TreeForce on positions/criteria to research. 2. Create a job registry based on online listings sorted by Job title found on platforms like ZipRecruiter, Teal, Indeed, etc.. 3. Analyze data collected from these listings to extrapolate statistics such as average salary, common locations, expected benefits, etc by job title. 4. Incorporate these statistics into a presentation. 5. Share/Present this information to the TreeForce team to be used in their programs. 6. Repeat once for Winter, once for Spring I was able to create presentations that articulated the breadth of the current employment landscape, with common job listings, locations hiring, skills necessary, salary expectations, and much more. This information is valuable to TreeForce because it allows them to adequately prepare their apprentices for this job market, and to adjust their employment expectations realistically after completing the program.

RACE-TO-THE-TOP DATA CENTER POLICY: ELECTRICITY, WATER, AND RATEPAYER PROTECTIONS ACROSS STATES

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My project looks at how the rapid growth of large “hyperscale” data centers is creating tradeoffs for electricity, water, and local communities. Although data centers make everyday tools like AI, cloud storage, email, and streaming possible, their resource use is concentrated in specific places, meaning the impacts are uneven across electric grids, utilities, and watersheds. Because there is no consistent federal framework for managing these tradeoffs, states are key decision-makers in whether data center growth becomes a “race to the top” in clean energy and efficient cooling, or a “race to the bottom” driven by incentives and cost-shifting. To evaluate this, I compare state policy approaches, especially Minnesota’s new data center law (HF-16) and contrasting examples like Virginia, to identify what governance tools best protect ratepayers and environmental resources while still allowing necessary infrastructure to expand. How can state policy can guide data center growth toward a “race to the top,” where new facilities support clean energy and efficient water use, instead of shifting costs onto ratepayers or stressing local resources. Data center electricity and water use is already growing rapidly, and state-level policy decisions are increasingly determining whether that growth supports or deters decarbonization goals and equitable outcomes. I used a multi-state comparative case study method, combining policy analysis of statutes and regulatory structures with targeted case examples to evaluate how states govern data center impacts on the grid, water, and communities. I then synthesized these findings to identify which policy tools best prevent cost shifting, support clean energy, and improve water governance as hyperscale projects expand. For my final tangibles, I wrote an essay, and am creating a data center policy state-by-state scorecard. My results show that impacts are directly correlated with maturity of states’ policy. Minnesota’s HF 16 bundles clean electricity compliance, ratepayer protection, and water-related permitting conditions into an early-stage governance framework, while other states with entrenched industries, like Virginia, face more reactive and fragmented policy debates. As an applied example, Minnesota’s approach is already shaping growth, including a case where a proposed Google facility is paired with

large additions of wind, solar, and long-duration storage funded by the company rather than ratepayers.

IMPROVING ACCURACY OF SUPER-RESOLUTION IMAGING

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This project aims to enhance super-resolution imaging techniques for deep tissue analysis. Current imaging methods are limited to superficial layers, which limits our understanding of activity of molecules in deep tissue, such as neurons. Imaging neurons in deep tissue can further our knowledge of learning processes. The Siemens Lab has demonstrated an imaging method that can image through 100 μm using spiral vortex super-resolution, but the resolution of the imaging is limited by how well the vortex is centered, and the current spiral being used does not take data from the full center of the beam. The research done in this project seeks to refine the previous method for deep tissue imaging. The purpose of this project is to use super-resolution imaging in deep tissue, specifically the brain, which is important because it can be applied to study the structure-function of neurons regarding the process of learning. Resolution of deep tissue imaging is limited by how well the vortex is centered, and this project focuses on refining the imaging technique by using a different method for centering the beam on the vortex than the one used in the original demonstration of this imaging technique. To find the center of the beam, this project used an interferometric technique that allows for the measurement of phase and intensity. In the previous demonstration of this imaging technique, intensity fitting was used to center the beam, which only relies on intensity. When both phase and intensity are used to determine the center of the beam, instead of just intensity, it is predicted this will output a more accurate reading. The phase reconstruction reveals a clear vortex singularity and uniform azimuthal phase progression, enabling precise identification of the beam center. Unlike intensity-based methods, which lack sensitivity to phase discontinuities, this approach directly captures the vortex structure. These results support the hypothesis that combining phase and intensity measurements improves centering accuracy, which is critical for enhancing resolution in deep tissue imaging.

ASSOCIATIONS AMONG EMOTION REGULATION, INTERPRETATION BIAS, AND PANIC SYMPTOMS IN COLLEGE STUDENTS

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Panic is a highly distressing domain of anxiety, with some people experiencing panic symptoms or attacks, as well as some people meeting criteria for a full diagnosis of panic disorder. Previous work has found a tendency to interpret ambiguous stimuli (interpretation bias) as threatening to be a consistent correlate of anxiety, and prior research in some domains of anxiety, as well as other symptom domains, has found emotion regulation to be a correlate of symptoms. Given that many models of anxiety and panic propose integrated mechanisms working together to contribute to symptoms, understanding if and how emotion regulation and interpretation bias may interact and associate with panic symptoms is relevant. This project tests several aims related to the above constructs with panic symptoms in college students in an online study. This study examines associations between interpretation bias and panic symptoms, emotion regulation and panic symptoms, and whether interpretation bias and emotion regulation interact to predict panic symptoms. This work may advance the literature by combining previously distinct research domains in interpretation bias and emotion regulation in the context of panic symptoms, and may ultimately lead to an improved understanding of how correlates of panic may also relate to one another. College students completed self-report measures of emotion regulation and panic symptoms, as well as a computerized task assessing interpretation bias for threatening content relevant to panic. The results describe associations between different dimensions of emotion regulation and panic symptoms, as well as how emotion regulation and interpretation bias interact in the context of panic.

GEOGRAPHIC HISTORY OF DAIRY FARMING IN MINNESOTA

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This project aims to view how the geography of dairy farming has changed in Minnesota and to compare the

geographic landscape of areas of high and low counts of dairy cattle. It was thought that the landcover of areas with more dairy cows would be mainly prairie allowing for more space for cattle, while areas with less dairy cows would be heavily forested as these areas provided much less space for cattle. It was also thought that the types of landscapes where there were high counts of dairy cows would change from 1860 - 2022 as technologies change and population increases. Utilizing GIS methods of analysis, the geographic landscape of high counties and low counties were statistically different, painting a picture of what areas are suitable for dairy farming in Minnesota. The landscapes also changed as flat cropland became dominant in the modern period while landscapes were more variable during early settlement. However, when comparing pre settlement landcover with the counties where there are high and low counts of dairy cattle in the modern period, there is not much change. How has the geography of dairy farming changed in Minnesota? How could this inform about the future of dairy farming as human activity continues to change the landscape? Compiled data from US Census of Agriculture into ArcGIS Pro along with landcover data from the Minnesota Department of Natural Resources. Used spatial autocorrelation methods to find areas of significance for each year, then used a chi square analysis to determine if the landcovers of significantly high areas were different from significantly low areas. Areas with high counts of dairy cattle had significantly different landcovers than those with low counts of dairy cattle in both the pre settlement period and the modern period. This gives a better insight into how dairy farming potentially changes the landscape of Minnesota and what are the aspects of the Minnesota landscape that make it great for dairy farming.

MY WORK WITH DENVER INC

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My project is going to be highlighting the impactful work I have conducted over the past year working as a development intern for Denver INC, where I conducted research on grant work and sponsorship that can help with the organization's mission.

UNDERSTANDING THE USE OF HUMOUR IN DIGITAL ACTIVISM

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As the world continues to change, young content creators on social media platforms are adopting the concept of the original intent of sharing and discovering humorous ideas, specializing in meme culture, to garner attention from the public discourse. This study investigated the impact of utilizing memes in combating social injustice, with a focus on the Israel-Palestine conflict, using quantitative content analysis of 243 TikTok videos posted since October 7, 2023, and tagged with hashtags #israel and #palestine through analyzing numerous frames, elements, and emotional tones of the videos. The data show that (1) framing the event as a war, though commonly found in the set, decrease interaction significantly, contrasting past insights showing that negativity drives engagement, and (2) employing humor to discuss and spread information about heavy topics significantly increases interactions. This study suggests that using humor in social movements is effective in widening its ability to reach the public, but the impact of humor left on the audiences is currently unclear. The finding highlights a contrast that humor invoked between the seriousness of social movements and platform-driven virality. Therefore, the study invites digital activists to be aware that using humor can desensitize the audience from witnessing pain and suffering, while encouraging media consumers to have a critical eye toward media portrayals.

INSTITUTIONAL CONSTRAINTS AND LEGISLATIVE AGENCY:HOW PARTY, INSTITUTIONS, AND COURTS SHAPE WOMEN'S HEALTHCARE POLICY POSITIONS

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This research addresses a significant gap in the literature by linking gendered legislative behavior to judicial rulings as policy-shaping events. While women's representation in healthcare is well documented, less is known about how judicial interventions function as critical junctures that reshape institutional incentives. The research will examine how legislators' stances, as captured through votes, correlate with policy actions, such as bill sponsorship

and committee leadership. Employing a mixed-methods strategy, the research also incorporates process tracing of legislative actions at the congressional level in response to significant rulings and bills, such as Planned Parenthood v. Casey (1992), the Partial Birth Abortion Ban Act (2003), the Affordable Care Act (2010), and NFIB v. Sebelius (2012). Although party affiliation remains the strongest predictor of healthcare voting behavior, women legislators, particularly those with institutional authority, can meaningfully shape and advance healthcare policy when judicial rulings alter the legal and political landscape. In these moments, leadership positions enable women to translate judicial constraints or openings into legislative action, framing, and agenda control that would not otherwise be available. This project is necessary because it moves beyond static analyses of representation to explore how female legislators respond dynamically to external factors besides party affiliation, offering a novel intersection between judicial politics and gendered policy behavior.

EVALUATION OF DPPH ANTIOXIDANT ASSAY IN THE BEER INDUSTRY

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Beer is a beverage that has been enjoyed by many different peoples across human history. In the modern world, beer is produced in vast quantities and may be stored for months before reaching the consumer. For the product to have its intended properties when it reaches the consumer, brewers must be attention to the shelf-life of their beer. An important class of compounds that contribute to shelf-life are known as antioxidants, which react with species that want to oxidize and thus degrade the beer. Many studies have been done on the antioxidant capacities of beer and other foods and beverages. A popular method is known as the DPPH assay. DPPH is a very strong oxidizer that is purple in solution, but when it is reacted with antioxidants, the color changes to yellow. Thus, one can measure the amount of light absorbed by the sample at a specific wavelength before and after the reaction happens and get information on how well the sample resists oxidation based on the absorbance changes. This works great for many applications, but there have been questions about the accuracy in a complex medium like beer. There is potential for side products or other compounds present to absorb at the same wavelength as DPPH, thus causing one to underestimate the amount of DPPH reacted. DPPH can be detected more precisely using spectroscopy such as Electron Paramagnetic Resonance (EPR). This project compares the data obtained from a DPPH assay in beer between the absorbance measured on a UV-Vis spectrophotometer and the intensity measured on an EPR spectrometer to evaluate the accuracy of UV-Vis as an analytical instrument for this application.

DEVELOPING A COMMUNITY NEWSLETTER FOR DRIVEN BY OUR AMBITIONS

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⁴Community Collaborator, PlaceBridge Elementary School

Assisting a local community organization in outreach and exposure to aid at-risk community youth in getting emotional and behavioral therapy. What resources are available to mitigate youth recidivism? After research, we reached out to various local stakeholders to evaluate what methods were in place to mitigate the high rates of youth recidivism. We then partnered with Daniel Sampson from DBOA to support him in his efforts to provide emotional and behavioral resources and a third space to Aurora youth. Our preliminary research yielded that youth recidivism rates are high, especially in disproportionately impacted communities. Working with Daniel, we created a community newsletter which highlights alternative spaces for youth to spend free time and receive mental health and wellness support from professionals.

THE WORLD OF GRANT-WRITING:FUNDRAISING FOR SUSTAINED FARMS

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The question my project seeks to address is: what strategies can be employed to optimize efficiency and effectiveness in securing grants, while upholding the general values of a non-profit? Non-profit work has arguably

become more important than ever due to compounded need, yet funding in the grant-giving world is increasingly limited.

THE FEASIBILITY OF AN AQUAPONIC INTEGRATED ECO-PARK AS CLIMATE RESILIENT INFRASTRUCTURE FOR DENVER COMMUNITIES

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In collaboration with residents of the Valverde Neighborhood and Center for Community Engagement (CCESL) at the University of Denver, this research project demonstrates the necessity and potential success of infrastructure designed to bring native ecosystems to urban areas, combined with food-security (agroecology) and natural disaster resistance measures (green engineering). Informed by successful and well-known conservation and urban gardening infrastructure of floating treatment wetlands and aquaponics, this demonstrates applying existing knowledge in new ways. Focusing on building and co-designing ecosystem and food security with the community, a large part of this project was participatory service and learning. As a part of the friendship and collaboration with Valverde that emerged, the Platte People's Project interviewed neighborhood leaders, conducted river walks, and began making zines to initiate conversations. The goal of this project was to design a way to provide extremely local tangible solutions for the most extreme consequences of climate change in Valverde: biodiversity loss ("loss of life"), systematic shocks to a large-scale food system, and exposure to extreme heat and other natural disasters. This idea helps answer calls from intergovernmental and local agencies for community-rooted solutions to these crises. The Platte People's Project was created to educate and advocate for an Aquaponic-Integrated Eco-Park (AIEP) for the South Platte River, co-designed with the Valverde Neighborhood during the summer of 2025. An AIEP combines the idea of reconstructing wetlands using floating platforms with aquaponics, the method of growing food without soil by fertilizing plants using nutrients from fish waste, and eco-parks (parks designed to rehabilitate the native ecosystem). PPP demonstrated the environmental, social, and policy feasibility of an AIEP to restore the river ecosystem of the South Platte River as it passes through Denver. This project studied the environmental, policy, and social feasibility of this idea. It concluded that an AIEP directly aligns with the environmental needs of the South Platte River, is supported robustly by the community and can be directly aligned to their interest and goals, and meets existing goals for sustainable development and resilience outlined in the Denver 2040 Plan. When presented to City of Denver Councilpeople and the South Platte River Committee, it garnered support. The project is now moving on to prototyping and expanding its team.

SEX EDUCATION IN COLORADO

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Adolescent sexual health education in Colorado is shaped by a policy landscape that supports comprehensive, medically accurate, age-appropriate, and inclusive instruction, while still allowing local districts to decide whether sexuality education is offered at all. This project evaluates the effectiveness of current adolescent sex education programs in Colorado from 2018 to 2026 in light of the recent legislation on sexual education curriculum. Given differing instructional policies across local districts, the landscape forms inconsistencies in health outcomes and equity. Despite advancements in the state's curriculum, disparities in knowledge, attitudes, and behaviors persist among youth, influenced by factors such as cultural context, socioeconomic status, and access to resources. Drawing on policy documents, state reports, organizational materials, and published literature, we comparatively analyzed adolescent health outcomes in relation to district-specific curricula. The study identified gaps, including limited resources for LGBTQ+ students, inequities in rural areas, and limited access to data. We aimed to address these disparities through an awareness campaign, including creating an informative pamphlet and partnering with local campaigns. The research seeks to contribute to the ongoing discourse around adolescent health education in Colorado, aiming to enhance the overall effectiveness and accessibility of sexual education for all youth. Recognizing the importance of medically accurate and inclusive education in promoting adolescent health equity, the research aims to assess the consistency with which current curricula support students' informed decision-making.

SPECIAL OLYMPICS COLORADO X DU CLUB SPORTS FIELD DAY & LONG-TERM PARTNERSHIP

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Our project is part of the Pioneer Leadership Program's Community Change Initiative series. It involved identifying a social issue and a need for sustainable change regarding an issue in our community. We identified a lack of social inclusion for disabled individuals as our main issue and chose to address that through extracurricular sports and activities. A large portion of the process included stakeholder interviews with potential community partners, such as National Sports Center for the Disabled (NSCD) and Special Olympics Colorado (SOCO). We chose (SOCO) and identified an opportunity to foster a longstanding partnership between DU Club Sports and their organization. We planned and carried out a Field Day for Special Olympics athletes and participants, collaborating with DU Club Sports and other on-campus organizations. This field day included stations with a variety of sports and activities for the athletes. A central aspect of this event was creating teams with a combination of disabled athletes and Club Sports athletes to emphasize the theme of community and sustained partnership. Furthermore, we intend for this to be an inaugural event that can be replicated in future years, along with a kickstart event for a Unified Club Sports Team as a part of DU Club Sports. The question our project addressed was "How can we attain higher levels of social inclusion for disabled individuals at the University of Denver by way of sport and activity, to foster a stronger sense of community within DU, as well as in the broader community of disabled athletes." Our team gained knowledge of the issue through stakeholder interviews, connecting with potential community partners. We connected SOCO with DU Club Sports and put together the Field Day as a kickstart event for the long-term partnership between DU x SOCO that will be a unified sports team as one of DU's club sports going forward. Our project's impact entailed connecting our community partners, putting on a successful kickstart event involving the DU community and spreading awareness, along with fostering a long-lasting, sustainable partnership between SOCO and DU.

ENHANCING COMMUNITY ENGAGEMENT THROUGH STRATEGIC COMMUNICATION WITH MDNA

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This project focuses on improving how a regional environmental organization connects with its community through accessible and clear messaging and more effective digital platforms. Through the strengthening of social media outreach, relationship maintenance with regional partners, and redesigning the organization's website, the project is trying to increase organizational awareness and accessibility as the organization gears up for the implementation of new projects. MDNA's mission is to "co-create a thriving region for people and nature" through the promotion of equitable access to flourishing outdoor spaces, acting as both a leader in their own projects and as a connective organization to bring together various nature and people-centered organizations. The project addresses how strategic communication enhance community engagement and awareness of environmental organizations, specifically MDNA, hoping to directly increase public participation and support for their sustainability efforts. I analyzed the existing communication strategies and digital content and then developed and implemented improvements to social media messaging and website structure to increase accessibility and engagement while still aligning fully with the organization's vision. The project helped to strengthen the organization's communication strategy by creating more consistency in communication and accessible messaging. Additionally, increasing coordination with regional partners and intentional promotion of their work helped to build stronger relationships for the organization and foster a collaborative environment, two keys to MDNAs work towards a regional vision for people and nature.

ECONOMIC DISPARITIES AS A PERPETUATING FACTOR IN INDIVIDUALISTIC PROBLEM SOLVING

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Economic inequality, or the gap between the rich and poor, has more than doubled since 1989 (Schaeffer, 2020). This widening gap is associated with societal harms such as increased violence and worse health outcomes (Gramlich, 2022; Pickett & Wilkinson, 2015). Although communal solutions are generally more efficient than individual ones (Frischmann, 2014), inequality may undermine people's willingness to cooperate. Prior work suggests individuals sometimes prefer to solve shared problems alone, even when this choice is inefficient (Gross & De Dreu, 2019). The present study extends this research by directly testing whether inequality drives such preferences. Participants are randomly assigned to high, low, or no inequality conditions before completing a 10-round decision-making game where problems can be solved individually or collectively. By examining how inequality shapes cooperative behavior, this study contributes to understanding one mechanism through which inequality sustains itself—by discouraging the very cooperation needed to address it. Does economic inequality exacerbate people's preference for individual problem-solving for shared problems (as opposed to collective problem-solving)? Previous research has indicated that people prefer to work individually to solve problems, and that this could stifle problem-solving efficiency. The present study utilizes a decision-making game adapted from a pilot study. In groups of four, participants are provided a hypothetical inequality level, and then asked to contribute hypothetical money towards a shared or individual goal through the 10-round game. While data collection is still ongoing, we intend to perform analyses via a multi-level model. We hypothesize that groups in higher inequality will prefer to contribute to individual goals, rather than shared goals, and thus be less efficient at meeting said goals.

MOUNTAIN PINE BEETLE IMPACT ON HETEROGENEOUS PONDEROSA PINE WOODLAND

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The mountain pine beetle (MPB) epidemic, due to decades of fire suppression and drought, has led to widespread ponderosa death across the western United States. Detecting these affected trees and areas early in the process is critical for land stewards to protect the surrounding ecosystem. This project compared two aerial images from 2023 and 2026 and, with machine learning, detected and mapped beetle-killed Ponderosa Pine trees near Floyd Hill, Colorado. We trained a random forest model on aerial RGB imagery to distinguish healthy trees from those showing spectral signs of infestation. Our results illustrate that accessible RGB imagery, combined with machine learning, provides a sufficient and accessible tool for monitoring MPB across ecosystems. Can easily accessible RGB aerial imagery, combined with random forest classification machine learning, accurately map red-stage mountain pine beetle-killed Ponderosa Pines? 1) Created a random forest classification model to detect whether a pixel is a tree and then if that tree has been affected by MPB, using different predictor variables and environmental factors. 2) Ran model on 2023 National Agriculture Imagery Program and 2026 UAV drone imagery. Our project suggested a random forest-based classification model can predict with 90%+ accuracy whether a tree is affected by MPB or not based on high-resolution RGB imagery alone.

GALOIS AUTOMORPHISMS OF CHARACTERS IN $Sp(4, Q)$

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Mathematics often studies symmetry, how objects can be transformed without changing their essential structure. For example, rotating a snowflake or making moves on a Rubik's cube both involve symmetries. These symmetries can be described using mathematical objects called groups. As groups become more complex, mathematicians use tools from linear algebra to better understand them. One such tool is a "character table," which summarizes key information about a group in a structured way. Studying these tables can reveal deep properties of the underlying symmetries. This project focused on how these character tables behave under certain transformations called Galois automorphisms, which reorganize the information in a meaningful way. In particular, I have investigated a recent advancement related to Brauer's Height Zero Conjecture, a major result connecting character tables to group structure. My research examined specific families of groups, the symplectic 4 group, to determine whether known patterns continue to hold more generally. The goal is to better understand how symmetry, algebra, and these transformations interact, potentially extending recent results to new cases. We are trying to answer the conjecture that states that for a given 2-block partition of $Sp(4, q)$, the characters fixed under our Galois automorphism are equal to the characters fixed and with height 0 if and only if the defect block is abelian. Focused on one block at a

time, and checked if the automorphism would fix the height 0 characters or not and cross check if the defect block was abelian. Ultimately, needed to understand how roots of unity were effected by the Galois automorphism. I was able to show that if q is congruent to 1 (mod 4), then the conjecture is true for $Sp(4,q)$.

SPEAKING CREATIVITY:DEVELOPING HANDS-ON PROGRAMMING FOR BROWNIE-AGED GIRLS IN THE DREAM LAB

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³Community Collaborator, Girl Scouts of Colorado

This project focuses on increasing engagement among Brownie-aged girls in the Girl Scouts Dream Lab, a creative and exploratory space designed to spark curiosity and build confidence in young girls. Bryanna and I identified a gap in structured programming for this age group and set out to develop a hands-on creative program to fill it. Our process involved researching successful youth engagement models, visiting other Dream Lab locations to learn what has worked elsewhere, and designing an age-appropriate activity centered around Cricut sticker machines — a creative tool that allows participants to design and produce their own stickers in an accessible and exciting way. The goal of this project is not only to create a single fun activity but to build a replicable program model that Girl Scouts of Colorado can continue to use and build upon, ensuring that Brownie-aged girls have consistent, meaningful access to the Dream Lab and the creative confidence it is designed to foster. How can the Girl Scouts Dream Lab better engage Brownie-aged girls through intentional, hands-on creative programming? Fostering early engagement in creative and exploratory spaces is critical to building confidence, curiosity, and a sense of belonging in young girls at a formative age. In developing this program, we conducted extensive research into existing Dream Lab spaces and youth engagement models, including site visits to other Dream Lab locations to identify what programming approaches have proven most effective for young girls. Drawing on these findings, we designed a hands-on creative program centered around Cricut sticker machines, coordinating with Girl Scout troop leaders to pilot the concept with Brownie-aged girls in a real program setting. Through this project we worked to create an accessible, engaging, and replicable program model that can be used to increase Dream Lab participation among Brownie-aged girls. By introducing a tangible, creative tool like the Cricut machine, we aimed to lower barriers to engagement and give young girls an exploratory space where they feel empowered to create freely.

THE CONTENTIOUS POLITICS OF ABORTION:UNDERSTANDING THE BLACK PROTESTS AND WOMEN'S STRIKES IN POLAND

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In 1993, the Polish Parliament, the Sejm, passed a law called 'The Abortion Compromise' permitting abortion only in cases when there is a serious threat to the life or health of the woman, pregnancy is the result of a crime, or prenatal tests show the fetus to be severely or incurably damaged. The current abortion laws in Poland are the most restrictive in all of Europe. Poland's abortion laws have undergone much contestation in recent years. In 2016, the Black Protests erupted across the country in opposition to a proposed total ban on abortion. In 2020, the Women's Strikes commenced as a reaction to a court ruling that banned abortion on the grounds of fetal impairment. This thesis seeks to understand why these episodes of contention developed. Theories of contentious politics, as advanced by Tarrow, offer explanations for why contention occurs. Tarrow's theory is confirmed by the Black Protests and the Women's Strikes. Zolberg offers explanations for when episodes of contentious politics are successful in achieving their aims. The Black Protests and the Women's Strikes disconfirm Zolberg's explanation. Analysis of Tarrow and Zolberg's theories suggests that Tarrow's theory travels well, but is not universal, that repression does not always deter mobilization, and that outcomes are cyclical, not permanent. Why did the Black Protests and the Women's Strikes develop? How did they achieve, or fail to achieve, their desired outcomes? This thesis applies a qualitative case study analysis. Tarrow's theory of contentious politics is confirmed by the Black Protests and the Women's Strikes. Zolberg's theory of outcomes of contentious politics is disconfirmed by the Black Protests and the Women's Strikes. Analysis of Tarrow and Zolberg's theories suggests that Tarrow's theory travels well, but is not universal, that repression does not always deter mobilization, and that outcomes are cyclical, not permanent.

THE IMPACT OF NOVEL SIGNAL EVOLUTION OF MALE AGGRESSIVE BEHAVIOR

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Male competition is widespread across animals and takes place when individuals compete against one another physically or non-physically with the goal of acquiring things such as mates, territory, or resources. Male competition within a species is a central mechanism of sexual selection, as prevailing individuals are more likely to secure mating opportunities and pass on their genes to subsequent generations. It is compelling to examine differences in male competition when traits are differentially selected for by females and the environment; for example, in the cricket *Teleogryllus oceanicus*, which has experienced rapid radiation of novel signals (songs) in response to an acoustically orienting parasitoid fly. Given novel songs are quieter, we examine whether these novel songs are associated with an increase in aggressive behavior. We examined the relationship between the evolution of quiet songs and aggressive behaviors to address the question of how the evolution of novel signals impacts intraspecific competition. We examined multiple populations with songs with different acoustic features and compared aggression across populations. One population is from Australia and produces the loud ancestral song while four others are from Hawaii, one of which produces loud ancestral song while the other three produce quiet novel songs. Aggression varied by male song type, and aggression totals revealed that Australian males were significantly less aggressive than all Hawaiian males. In contrast, none of the Hawaiian males differed significantly from each other, indicating broadly similar aggression levels among males from Hawaii. This helps to elucidate the impact of the origins of novelty on male aggressive behavior.

PROJECT FOR AFFORDABLE TRANSPORTATION AND HOUSING (PATH)

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We are completing a yearlong community change initiative, for which we are currently seeking grant funding. The intent is to address the housing affordability crisis in Denver's metropolitan area, and its subsequent correlation to the efficiency and reliability of the city's public transportation system. Communicating with external stakeholders is a significant component of this project. To better understand the complexity of housing and transportation affordability, we facilitated conversations with over twenty community members and stakeholders (government leaders, building and development experts, service and housing support providers, researchers, and community and access advocates). Currently, we are compiling data in partnership with the Department of Housing Stability for Denver (HOST) and the Regional Transportation District, to better tailor solutions to this entrenched problem. Location affordability consists of the combined living costs of transportation and housing expenses. The lack of efficiency and reliability in Denver's public transportation system often forces affected communities to choose between location, cost and/or opportunity. It creates a tradeoff between expensive housing in central areas, or affordable locations with limited transportation access, oftentimes far from the city. Collaborated with HOST to create a shared community-centered solution: Understanding the needs, perspectives, and ideas of college students regarding housing affordability. Designed and distributed flyers and a survey with Universities in the Denver Metro, collecting data to support HOST's goals. Survey responses are currently being collected and will be used by HOST to inform decisions on how to support college students and to identify emerging risks regarding housing affordability. Our project has also strengthened connections between HOST and the universities in Denver for future collaboration!

INVESTIGATION OF CLATHRIN RECRUITMENT DURING MVE EXOCYTOSIS IN A549 CELLS

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Every cell is wrapped in a "skin" called a membrane that controls what enters and leaves to keep the cell healthy. To stay balanced, cells use a process called exocytosis to spit out tiny packages (vesicles). Our study used specialized high-resolution microscopy to watch these packages being released in real-time within human lung cells. We discovered that a specific protein called Clathrin gathers exactly where these packages are released, acting like a

crew that helps manage the cell's surface tension and overall stability. This project investigates whether Clathrin is present during the exocytosis of multivesicular endosomes (MVEs) to understand its role in regulating cell membrane balance. Determining this relationship is crucial for understanding how cells maintain equilibrium and regulate surface tension through vesicle release. Total Internal Reflection Fluorescence (TIRF) microscopy was used to record live A549 human lung cells, tracking the specific markers CD63 and Clathrin. Additionally, temperature modifications (optimizing for 37 degrees Celsius) were applied to manipulate membrane tension and encourage clathrin-mediated protein recruitment. The project revealed that clathrin-mediated pathways initiate directly at and adjacent to MVE fusion sites, suggesting that exocytic protein recruitment is a primary driver of membrane regulation. Although fusion frequency was low, these findings establish a foundation for hypothesizing how cells can dynamically manage their internal and external environments.

EXPLAINING VARIATION IN MEDICAL AID IN DYING POLICY ACROSS U.S. STATES

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Medical Aid in Dying (MAiD), a practice that allows terminally ill patients to choose the timing of their death, is legal in some U.S. states but banned in others. At first glance, you might expect this to follow a simple political pattern, with more liberal states allowing it and more conservative states opposing it. However, this project finds that the reality is much more complicated. Through a combination of nationwide data and in-depth case studies of Montana, Colorado, and West Virginia, this research explores why states with similar political environments can end up with very different policies. The findings show that where and how the issue is debated matters just as much as people's beliefs. Policies change differently depending on whether they are decided in courts, state legislatures, or through public votes. The project also highlights how the way the issue is described (for example: whether as "medical aid in dying" or "assisted suicide") can shape public opinion and political outcomes. In some states, strong disagreements within political groups prevent clear decisions, while in others, unified support leads to firm laws, either allowing or banning the practice. Overall, this project shows that decisions about deeply personal and moral issues are not just about political views, but about how institutions, messaging, and group dynamics shape the final outcome. These findings help explain not only MAiD policy, but also other debates about personal autonomy and medical ethics in the United States. This project asks why Medical Aid in Dying (MAiD) laws vary so widely across U.S. states, rather than following a clear political pattern. Understanding this matters because it reveals how decisions about deeply personal issues, like end-of-life care or other bodily autonomy policies, are shaped not just by beliefs, but by political systems and processes. This project combines a nationwide dataset of MAiD policies across all 50 states with in-depth case studies of Montana, Colorado, and West Virginia. By comparing how laws were adopted or prohibited in different institutional settings, it analyzes how political processes, messaging, and group dynamics shape policy outcomes. The results show that differences in how MAiD policies are decided, through courts, legislatures, or ballot initiatives, play a major role in whether the practice is legalized, restricted, or left unclear. This highlights that outcomes in morally personal policy areas are shaped not just by political beliefs, but by the systems and processes through which decisions are made.

UNDERSTANDING FACTORS ASSOCIATED WITH EARLY CHILD SOCIAL COMMUNICATION IN FAMILIES EXPERIENCING SOCIOECONOMIC ADVERSITY

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This project explores how parent-child interactions are associated with children's social communication skills in families experiencing significant socioeconomic adversity. We found a significant association between higher parental sensitivity, defined as parents responding accurately and consistently to their child's cues, and children's initiating behavior requests.

ISOLATION AND ANALYSIS OF ASTROCYTE-AND MICROGLIA-DERIVED EXOSOMES FROM 3XTGAD MOUSE BRAIN TISSUE

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In this project, we isolated exosomes, vesicles released by cells carrying cell-type specific cargo, from astrocytes and microglia, two brain cells shown to play an important role in neuroinflammation. To isolate exosomes from these cell types, we used an immunoaffinity magnetic bead-based technique. We validated this technique using transmission electron microscopy and nanoparticle tracking to confirm the size, concentration, and morphology of the exosome samples. We then isolated astrocyte and microglia-derived exosomes from four mouse groups, old and young triple transgenic Alzheimer's disease mice and old and young wild-type mice. We then conducted immunoassays with these samples to compare the concentrations of proteins associated with neuroinflammation in each group. We found that proteins associated with inflammation were higher among astrocyte-derived exosomes from the old Alzheimer's disease group than other mouse groups. In this project we validated a novel protocol for the isolation of astrocyte- and microglial-derived exosomes from mouse brain tissue. We then assessed proteins associated with neuroinflammation present in exosomes isolated from 3xTgAD and wild-type mouse models. We used an immunoaffinity magnetic bead-based isolation method to isolate exosomes from the mouse brain tissue, and then used transmission electron microscopy, nanoparticle tracking, and western blots to validate the protocol. We then used immunoassays to assess proteins present in the samples. The validation of this protocol confirmed that the size, morphology, and concentration of our samples was consistent with exosomes. Immunoassay data showed a trend that proteins associated with neuroinflammation were at a higher concentration in astrocyte-derived exosomes from the old Transgenic Alzheimer's disease mouse group.

THE ORBITAL ANGULAR MOMENTUM OF LIGHT

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The orbital angular momentum (OAM) of light has uses in optical communication and The orbital angular momentum (OAM) of light has uses in optical communication and microscopy, but is manifest in light's phase and can't be directly measured with a camera. We propose that OAM can be measured using diffraction from a grating, and demonstrate quantitatively-accurate OAM measurements of a variety of modes.

POLARIZATION IN TYPE IC SUPERNOVAE

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We use the amount of light coming from supernovas at different wavelengths to determine what elements are present in the supernova and how fast they are moving. We also use the polarization of the light (how much of the light is oscillating in the same direction) to determine the shape of these elements in the supernova. What is the relationship between wavelengths and the polarization of light in a type 1c supernovae over its lifetime? We are aiming to use polarimetry data from three supernova (in this case Sn 2014 L, 2012 FH and 2014 AD) to gain a greater understanding of the behavior of type 1c supernovae as they evolve over their lifetime I used python to create graphic representations of the data sets, specifically flux and polarization versus wavelength and Stokes q-u plots. From these graphs I was able to identify some polarization signatures that correspond to elemental absorption and emission spectra in the flux spectrum. By analyzing these supernovae, I was able to conclude that all three have a non spherical structure and distinct behaviors of different elements. I was able to compare the elements present in the three supernovas between their photospheric and nebular phases.

MOVEMENT REVOLUTION: HOW DOES LOCOMOTORY BEHAVIOR OF TELEGRYLLUS OCEANICUS DIFFER BETWEEN SEX AND GENETIC POPULATION?

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Pacific field crickets (*Teleogryllus oceanicus*) use acoustic communication to facilitate reproductive opportunities. Male crickets produce loud, long-distance calling songs by scraping their wings together to attract females for mating. Yet, in Hawaii, these crickets have developed silent and novel songs as an adaptive response to parasitism from lethal acoustically-oriented flies (*Ormia ochracea*). The parasitoid fly follows the loud, calling songs to locate

potential hosts to lay their larvae in; resulting in host death after the larvae reach maturity. The silent and novel songs prevent parasitism, but make it difficult for female Pacific field crickets to acoustically locate males for mating. As male cricket songs become less effective in attracting mates, locomotory behavior may increase in importance for males and females since it aids in the successful location of mates when their primary sexual signal is lost. This leads us to ask if locomotory behaviour differs between Hawaiian *T. oceanicus* populations and ancestral populations; and if increased locomotory behavior differs between females and males. How does locomotory behavior of Pacific field crickets differ between sex and genetic population? Has locomotory behavior changed as an adaptive response to mating search challenges and sexual selection of novel songs? We isolated 20 males and females from six different genetic populations based on their geographic location (Manoa, Kapa'a, Mo'orea, Tahiti, Cairns, and Daintree) for exploratory trials. We measured locomotory behavior by observing the number of lines they crossed and the time to start moving within a grided circular arena, to conduct a one-way ANOVA analysis. The research is ongoing, and the data is being collected for analysis. Yet, it is expected that ancestral populations will display less locomotory behavior and that females will be the more locomotory sex; which will help us better understand animal locomotory behavior and intermediary behaviors that result in speciation.

IF/THEN:PROCESS-BASED MUSIC AND CASSETTE TAPES

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If/Then is a music production project exploring music composition, recording, and mixing with the use of the ostensibly obsolete technology of cassette tapes in tandem with modern digital audio workstation software. This project generated a wide variety of novel production techniques, and the music produced, a full-length experimental electronic album titled "If/Then", expresses these techniques and their emergent musical elements. How does the technology of cassette tapes, and more generally, storing musical information physically, influence, limit, and expand creative music production? I used a 3-head cassette deck, a four-track cassette recorder, and a wide variety of cassettes to replace standard mixing processes, such as EQ or saturation, to manipulate music physically by interacting with the tape before and during playback, and to introduce "concrete" elements into otherwise standard compositions. In retrospect, the album of music I produced through this project communicates nostalgia through its sonic palette, which while unintentional, was an emergent process brought out through the imposed limitations of the project. I believe the work to be of very high quality and novelty, and the process of creation was challenging, informative, and inspiring in the ways I was hoping it would be.

WELCOME HERE:EXPANDING ACCESS TO LEGAL RESOURCES AND REPRESENTATION FOR OUR IMMIGRANT NEIGHBORS

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³Community Collaborator, Board Chair and Co-Founder of Colorado Immigrant Justice Fund

As part of the Pioneer Leadership Program's second-year Community Change Initiative, we endeavored to support our immigrant neighbors. This project seeks to increase access to legal resources and services for immigrants, as well as help make the immigration system more approachable. Through multilingual, information-rich booklets, Welcome Here helps save the time of wading through resources to seek the necessary support for immigrant communities from a variety of backgrounds. Additionally, it is part of a larger course of action to expand access to legal resources and knowledge in a variety of languages in order to allow for multiple communities to receive concise and accurate information about the resources available to them and their families. How do we make the immigration system as approachable and accessible as possible? In our research and conversations with organizations across the community, we have found that there are significant barriers to accessing legal services and understanding how the American immigration system works. We want to know how to support and empower as many immigrants in our community as possible with knowledge and tools to navigate the immigration system, seek legal counsel, and stay safe in the face of heightened aggression and national tension. We interviewed more than 30 community members to determine what the highest needs in our community were when it came to supporting immigrants. Developing relationships with our community allowed us to determine where we would be most impactful. This project led to the production of booklets explaining the legal processes associated with immigration, and the compilation of a directory of local resources to support those processes. These booklets are

multilingual, free, and widely available, and will additionally be distributed at a fundraising event to support the Colorado Immigrant Justice Fund.

HOW DATA CAN IMPROVE AI COACHING FOR YOUNG PROFESSIONALS

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My project was about helping an education technology company improve an AI coaching tool for young professionals. The company is called The Experience Accelerator, and their tool, Avatar Coach Kate, is meant to help users build leadership skills, confidence, and resilience as they start their careers. My role was to use data to help the team make better decisions. I built a system to compare possible partner organizations, created a dashboard to track where users were dropping off during the sign-up process, and researched risks related to generative AI, especially privacy, explainability, and responsible use. This project matters because more people are starting to use AI tools for learning and career growth, but those tools need to be designed carefully to actually help people. My work helped the company better understand user behavior, improve reporting, and set clearer guidelines for how the product should grow. My project asked: how can data be used to help an AI coaching platform for young professionals make better decisions about partnerships, user engagement, and responsible growth? This question matters because AI tools can only really help people if they are designed carefully, based on real user patterns, and supported by clear privacy and policy guardrails. I answered this question by building a normalized dataset and weighted scorecard to compare partner programs across more than 15 criteria and identify the strongest options and biggest policy risks. I also mapped the user acquisition funnel, built a weekly KPI dashboard to track drop-off points, and reviewed Generative AI issues like privacy, explainability, and RAG to create a risk brief that could guide product decisions. My project gave the team a clearer way to make decisions. The scorecard helped prioritize partners and flag risks, the KPI dashboard showed where users were dropping off in the acquisition funnel, and the AI risk brief helped set policy guardrails around privacy, explainability, and responsible product growth.

WHAT IS "WEAVING"?:FOSTERING COMMUNITY ENGAGEMENT IN DENVER NEIGHBORHOODS

Caitlin Turk¹, Logan Schmid¹, Cara DiEnno², Stefan Chavez-Norgaard³, Keither Meyer⁴

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⁴Community Contributor

We are working to bolster Denver Inter-Neighborhood Cooperation (INC)'s social media presence, specifically on Instagram, to further community engagement. We have interviewed numerous members of Denver INC, DU, the Aspen Institute, and the Denver community in order to learn their stories and highlight their successes. We edited these videos and combined them with graphics we created on Canva. We are also working to create more content for the Instagram about Denver INC events, the importance of neighborhood engagement, and new ideas for videos. How can social media be used to increase awareness and participation in actions that benefit Denver neighborhoods—"weaving"? To answer our research question, we used a variety of methods, including social media graphic posts; recorded interviews with "weavers;" and videos, clips, and photos of Denver INC events. Our project met our goals through increasing Denver INC's social media presence to 2-3 posts a week, gaining several followers and likes that represent increased engagement. These posts have improved the community's knowledge of Denver INC and what "weaving" actually is, preparing Denver INC Instagram followers well for when weaving awards will be distributed to the community.

HOW DOES JOINING A CLUB IMPACT THE FATE OF THE UNITED STATES?

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³Mentor, Center for Community Engagement to Advance Scholarship and Learning

Rooted in Robert Putnam's research on how American communities impact democracy, this project aims to apply this research into an impactful actionable plan to encourage stronger community connections and engagement amongst the DU community to promote a stronger community, civic engagement, and a healthier democracy. By connecting the Korb School of Global and Public Affairs, the Center for Community Engagement to Advance

Scholarship and Learning (CCESL), Denver Inter-Neighborhood Cooperation (DenverINC), and the Scrivner Institute of Public Policy, we created an event built around Putnam's research in hopes to encourage DU students to engage in their communities in more meaningful and impactful ways. The event featured a screening of the documentary, *Join or Die* (a documentary on Putnam's research), a panel of DU faculty who are dedicated to community scholarly work, and Snarf's Sandwiches catering. By understanding how the lack of club engagement and participation is impacting the American loneliness epidemic and democracy, this project aims to understand ways the community can support the American youth while also understanding ways the American youth can better support their communities to promote stronger civic engagement and community connections. Analyzing documentary, event planning, multi-organization coordination and collaboration. We met our goals by putting together a collaboration event for a *Join or Die* screening alongside CCESL, DenverINC, Korbel, and the Scrivner Institute of Policy for April 17. Since this date has not passed yet, specific details and numbers are hard to provide.

EVALUATING PURPLEAIR FLEX AND SD SENSOR PERFORMANCE FOR PARTICULATE MATTER MONITORING AT THE KENNEDY MOUNTAIN CAMPUS

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Air pollution is an increasing global health concern, yet regulatory monitoring tools remain limited due to high cost and inaccessibility. Low-cost devices, such as PurpleAir sensors, offer a feasible solution to supplement more expensive monitoring tools, despite their technical limitations. As a part of an undergraduate thesis project, this research is investigating particulate matter (PM) concentrations using PurpleAir sensors while also investigating differences between two models; the II-SD and Flex. Six PurpleAir PM sensors are co-located in pairs (II-SD and Flex) at three sites at the University of Denver's Kennedy Mountain Campus (KMC) NW of Fort Collins, Colorado near Red Feather Lakes and have been deployed for continuous measurements since April 2024. Measurements of PM_{1.0}, PM_{2.5}, and PM₁₀ are recorded over 10-minute intervals, along with humidity, temperature, and atmospheric pressure. The poster will present an overview of PM trends at the site as well as an intercomparison between the two PurpleAir models. This work aims to further introduce the KMC as a nascent atmospheric monitoring site easily accessible to the Front Range research community by highlighting nearly two years of PM data in the low mountain region. This project investigates low-cost PurpleAir sensor performance in a rural, high-elevation forest environment by evaluating differences between two PurpleAir models (the II-SD and Flex) to further understand their viability as accessible supplements to traditional air quality monitoring networks. Six PurpleAir sensors were installed at the University of Denver's Kennedy Mountain Campus (KMC) on February 25th, 2024 where they were connected to WiFi for continuous operation. Data is continuously downloaded on a bi-weekly period using PurpleAir's downloading software which captures measurements of PM_{1.0}, PM_{2.5}, and PM₁₀ alongside temperature, humidity, and atmospheric pressure at 10-minute intervals using their integrated ATM conversion. Collected data was then consolidated and analyzed using IGOR Pro to identify particulate matter trends and evaluate performance differences between the two sensor models. The results of the study advanced our understanding of particulate matter trends in a rural, forested, high-elevation location by building a continuous dataset spanning over two years. These findings contribute to a growing investigation evaluating the reliability of low-cost air quality sensors, offering insight into whether devices like PurpleAir can serve as reliable alternatives to traditional monitoring equipment and how they can be used to better understand atmospheric conditions and air quality.

TURNING BARRIERS INTO OPPORTUNITIES:HOW ENTREPRENEURS NAVIGATE INSTITUTIONAL VOIDS

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Entrepreneurship is often portrayed as a process driven by innovation, passion, and access to resources. However, in many parts of the world, entrepreneurs operate in environments where key systems such as infrastructure, financing, and formal institutions are unreliable or absent. This project explores how entrepreneurs navigate these "institutional voids" through a study of business leaders in Guatemala. Using in-depth interviews with entrepreneurs, investors, and ecosystem actors, the study finds that success depends less on following established models and more on adapting to systemic constraints. Many entrepreneurs distinguish between necessity-driven

ventures and passion-based entrepreneurship, showing how limited opportunity shapes motivation. Government inefficiencies, corruption, and infrastructure gaps often become drivers of innovation, pushing entrepreneurs to create their own solutions, develop alternative financing approaches, and rely on trusted networks. The findings also highlight the importance of exposure to success stories and experiences outside the local ecosystem, which expand what entrepreneurs believe is possible. Overall, this research shows that entrepreneurship in resource-constrained environments is defined not by the absence of opportunity, but by the ability to navigate and reshape the systems in which businesses operate. This project examines how entrepreneurs succeed in environments where key systems—such as access to funding, infrastructure, and institutional support—are limited or unreliable. Understanding this is important because many regions around the world face these conditions, yet most entrepreneurship education is designed for more stable environments. We conducted in-depth interviews with entrepreneurs, investors, and ecosystem actors in Guatemala to understand their experiences. These interviews were coded and analyzed to identify common challenges, strategies, and learning processes. We found that entrepreneurs develop creative strategies to overcome systemic gaps, including combining different funding sources, building their own solutions, and relying heavily on networks and mentorship. These findings suggest that entrepreneurship education—and the way we talk about entrepreneurship more broadly—should be reframed to better reflect the realities of operating in less-developed ecosystems, rather than assuming the conditions found in more developed contexts.

SUSTAINABILITY ON STAGE: A CASE STUDY IN CARBON-NEUTRAL THEATRICAL PRODUCTION

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This hybrid portfolio-thesis attempts to address two questions: How does environmental sustainability intersect with live theatre? And how do we emphasize the importance of environmental sustainability in the theatre department here at DU? To answer these questions, I created Project Objectives and Guiding Principles for my Senior Capstone Production team to follow in sourcing their necessary materials (scenery pieces, costume items, lighting needs, etc.) I also worked with the Tech and Costume Shops here at DU to sustainably source materials we construct in-house, while discussing the life cycle of every item used in the production. The result of this project is a completely sustainably-sourced senior capstone show, something that has never been done before in the Theatre Department at DU. By sourcing all our materials from second-hand avenues, we have significantly reduced the carbon footprint of the department this quarter while also reducing spending costs. Analyzing the final budget and spending patterns has shown that producing a fully sustainable play with second-hand or sustainably sourced materials is actually more cost-effective to the department and student designers than it would be to purchase new; this data highlights the importance of thoughtful spending and environmental awareness in the design process.

EFFECTS OF MECHANICAL PROPERTIES ON CO RELEASE RATES FROM HYDROGELS

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Carbon monoxide (CO) is usually thought of as a harmful gas, but scientists have recently found that very small, carefully controlled amounts of it may actually help the body. In particular, CO can reduce inflammation and protect cells from damage. One challenge is getting CO to the right place in the body safely. To do this, researchers use special compounds called carbon monoxide-releasing molecules, or CORMs, which store CO and release it when triggered. The Worrell lab is studying a new type of CORM made from a chemical called diphenylcyclopropanone (DPCP). This compound releases CO when exposed to violet light. The researchers can attach DPCP to soft, water-rich materials called hydrogels, which are often used in medicine to deliver drugs. These hydrogels are made from PEG, a material that is safe for the body and can be adjusted to be softer or stiffer. My role in the project is to study whether the stiffness of the hydrogel changes how quickly it releases CO. To do this, I change how much solid material is in the hydrogel, which changes its stiffness, and then measure how fast the CO is released. Although the lab has already shown that these hydrogels can release CO, we still do not know how fast the release happens or how the hydrogel's stiffness affects it. The question asked is how the modulus of Hydrogels would effect the CO release rate. The importance of understanding this release rate is to control and optimize how

much CO is delivered and how quickly it is released. Hydrogels with different stiffnesses will be made by changing the amount of PEGDMA and DEGDMA in the mixture and adding a light-sensitive carbon monoxide-releasing compound. The stiffness of each hydrogel will be measured, then the hydrogels will be exposed to different amounts of ultra violet light to trigger CO release, allowing the relationship between hydrogel stiffness and CO release rate to be analyzed. It was found that decreasing the solid wt% produced substantially faster and higher apparent CO release, with 10 wt% hydrogels consistently exhibiting the most rapid CO accumulation in solution. Vice versa was also observed, higher-solid-content hydrogels (40 wt%) showed slower CO release kinetics.

CATHETER DESIGN FOR LASER ABLATION OF REDO-TAVR PROCEDURES

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Transcatheter Aortic Valve Replacement (TAVR) is a minimally invasive procedure used to treat severe narrowing of the heart's aortic valve and is an alternative to open-heart surgical valve replacement. TAVR is increasingly performed in younger patients, so many patients will outlive their first valve and need a second valve replacement called redo-TAVR. In redo-TAVR, a second valve is deployed inside the existing valve, displacing the existing leaflets and potentially blocking blood flow to the coronary arteries. The objective of this project was to design a catheter for laser ablation of the existing leaflets in redo-TAVR. An outer delivery catheter and inner steerable catheter were developed. The catheters were designed to have outer diameters of 20.88 Fr and 11.4 Fr, to accommodate optical fiber on the inside while remaining compatible with arteries. Both catheter designs layered an inner PTFE liner to allow smooth device and guidewire movement, stainless steel braided reinforcement, and Pebax outer tubing to balance flexibility, pushability, and kink resistance. The outer catheter was designed to follow a guidewire into the heart's aorta and provide stability during ablation. The inner catheter design incorporated a pull wire mechanism for the controlled deflection of the catheter tip. The outer catheter was fabricated and evaluated, using 3D printed models of three patient's aorta and left ventricle. The testing focused on the catheter's mechanical performance and its ability to navigate the aorta. The catheter demonstrated strong pushability, successfully navigating through the aortic arch and down into the aortic valve. However, localized kinking was observed in the arch, indicating the need for increased reinforcement. These results support future research by demonstrating successful fabrication methods and informing continued optimization of catheter design for redo-TAVR.

ZINC CAN INTERACT WITH MICROTUBULES TO REGULATE MICROTUBULE STABILITY AND PROTECT MICROTUBULES FROM DAMAGE

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This project uses live cell imaging techniques to explore how microtubule-associated proteins (MAPs) and zinc (Zn) can affect the stability of microtubules. Previously, different proteins have been associated with microtubules. Additionally, previous work in the Qin lab has shown that Zn can interact with microtubules. However, the exact mechanism involved and physiological effect remains unexplored. This research supports the idea that Zn and certain MAPs play a stabilizing role to help protect microtubules from different types of damage. How do zinc and microtubule-associate proteins affect microtubule stability, and how are these processes important for normal physiological conditions? This project used live-cell fluorescence microscopy with COS7 cells to see real-time effects of certain drug treatments. Results from this project supported the idea that Zn and MAPs can protect microtubules from certain types of damage and are important for future research on the impact of zinc-related disorders on cell stability and overall health.

PHOSPHOLIPASE D FACILITATES EXOSOME SECRETION THAT MAY HELP TRANSPORT NEURODEGENERATIVE PROTEINS

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Cells release small packages called exosomes to transport materials to other cells or dispose of waste. Two enzymes, PLD1 and PLD2, help cells release exosomes by producing a molecule called phosphatidic acid, which

stabilizes the curved membranes required for exosome release. TDP-43 is a protein that normally stays in the nucleus of a cell, where it helps process genetic information. However, when TDP-43 ends up outside the nucleus, it clumps together and can contribute to neurodegenerative diseases like amyotrophic lateral sclerosis (ALS). This project investigates whether exosomes can transport TDP-43 between cells. If so, this could explain how harmful proteins spread through the brain and contribute to disease progression. What is the role of PLD1 and PLD2 in exosome secretion? Are exosomes able to transport neurodegenerative proteins (like TDP-43) between cells? For PLD1/2, confocal microscopy with immunofluorescence techniques were used to determine colocalization of CD63 and PLD1/2. For neurodegenerative proteins, confocal microscopy was also used to examine colocalization, but rather than immunofluorescence, cells were manipulated to produce biological markers on proteins of interest (TDP-43 and CD63). PLD1 and PLD2 are colocalized with CD63, which supports their role in facilitating exosome secretion. TDP-43 and CD63 show moderate correlation, but at a significantly lower level than PLD1/2 and CD63. This suggests that TDP-43 is associated with exosomes, and that TDP-43 may be carried between cells in exosomes.

BREAKING BARRIERS:EMPOWERING WOMEN THROUGH SPORTS BY PROMOTING EQUITY AND VISIBILITY

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This project is about recognizing the challenges women in sports still face and working to change them. It focuses on increasing visibility for women athletes, building stronger support systems, and creating more inclusive spaces where they feel valued and respected. By using digital platforms to highlight achievements and amplify voices, we helped women show up with confidence, be seen for their talent, and have the same opportunities to grow, compete, and lead. Despite major strides towards equality, women in sports still struggle against barriers that prevent them from receiving the same respect, resources, and strong community connections. We used interviews and research to understand key challenges, then used social media outreach, sponsorship efforts, and personal connections to expand visibility and support. We also engaged directly with the community through tabling to build awareness and strengthen relationships. While the project is still in its early stages, it has already begun building awareness and generating interest through outreach, social media engagement, and community connections. Early responses show increased visibility and growing support for women's sports, helping establish a strong foundation for future partnerships, participation, and measurable impact.

BIOLOGICAL RHYTHMS IN CRICKET IMMUNE ACTIVITY

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Biological rhythms coordinate behaviors and physiology with the environment. Immune function is one such biological rhythm, and given that it is energetically costly to operate, it may be beneficial to coincide peak immunity with times-of-day that infection risk is highest. Male *Teleogryllus oceanicus* crickets sing at dusk to attract female crickets to mate; however, their song also attracts the deadly, acoustically-orienting parasitoid fly *Ormia ochracea*. In this study, we examined whether immune function peaks at times-of-day when the fly is most actively host-seeking, and thus likely to infect singing male crickets. We tested whether immunity varies across time-of-day and between parasitized (Hawaiian) and unparasitized (Australian) cricket populations. Specifically, we wanted to observe if peak activity coincides with "risky" times-of-day, and/or varies across populations. We evaluated two measures of immune function (melanization of a foreign body (n=90) and immune cell count (n=115)) over a 24-hour period in a parasitized (Hawaiian) and unparasitized (Australian) population. Although we did not detect a significant difference between the timing of peak immune function in the Australian (unparasitized) and Hawaiian (parasitized) populations, we discovered that for both populations, immunity peaked when the light began to transition to dark phase (i.e., dusk). Our findings bolster that male crickets have evolutionarily primed their immune function at the start of the dark phase (i.e., the onset of their active period), which coincides with the time-of-day they are most likely to encounter pathogens and/or parasites.

CARDIOMYOCYTE-ENDOTHELIAL CONTACTS DURING HEART REGENERATION

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Heart disease is the leading cause of death worldwide. Unlike humans, zebrafish can regenerate their hearts after injury. My thesis focuses on understanding heart regeneration in zebrafish, a model organism capable of scar-free cardiac repair. Previously, proximity labeling proteomics (BioID2) was used to investigate the β -catenin interactome during heart regeneration. β -catenin is a dual-function protein involved in Wnt signaling and cell adhesion. While the role of Wnt signaling in heart regeneration has been studied, it remains unclear. Unexpectedly, the BioID2 screen revealed a strong interaction between β -catenin and Cadherin-5 (Cdh5), an endothelial adhesion molecule, with no change in interactions with Wnt signaling proteins. My work used immunofluorescence to examine Cdh5 and β -catenin localization in uninjured and regenerating hearts and found that Cdh5 accumulates around blood vessels after injury, implicating cardiomyocyte–endothelial adhesion as a key mechanism in heart regeneration. Despite the well-established role of β -catenin in cardiac biology, the molecular interactions through which it contributes to heart regeneration remain unknown. Identifying these interactions in the zebrafish model is critical to uncovering the cellular mechanisms that enable scar-free cardiac repair, knowledge that could eventually treat heart disease in humans. Proximity labeling proteomics (BioID2) was used to map the β -catenin interactome in uninjured and regenerating zebrafish hearts, identifying Cadherin-5 (Cdh5) as a strong candidate interaction. Immunofluorescence was then used to examine the localization of β -catenin and Cdh5 in cardiac tissue across uninjured and regenerating conditions. Immunofluorescence revealed that Cdh5 and β -catenin change localization in the regenerating heart, with Cdh5 levels decreasing and β -catenin levels increasing in blood vessels following injury. Both proteins, were found to localize to cardiomyocyte-endothelial cell contacts, suggesting that remodeling of adhesion complexes at these junctions may be a key feature of cardiac repair.

DOES MOOD IMPACT HOW WE BOUNCE BACK AFTER MAKING A MISTAKE?

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The eyes are a window to the mind, allowing us to understand what's happening in the brain through changes in pupil size. The PEAR project studies how people recover from mistakes during a challenging cognitive task, completed under differing reward contexts, and what changes in a person's pupil diameter during the task can tell us about that recovery process. A large part of performance in this task is how participants recover after making a mistake — if they got something wrong, would they be able to get the next one right? And what do their pupils do in this process? We call this recovery from error. To examine how these questions may vary depending on mood, participants completed a mood survey after the task. In this poster, we explore what a participant's mood might tell us about how they recover. We compared task performance and simultaneously collected pupil activity in people who reported positive vs. negative mood to see how they might differ in their recovery from error. This can tell us more about how mood influences everyday performance; for example, does feeling more positive help us bounce back faster after making a mistake? How does emotional state, specifically positive and negative mood, influence how we recover from errors during a cognitive task? Understanding how mood shapes recovery can provide valuable insights for psychological researchers, with long-term implications for applied (e.g., clinical, educational) domains. Participants completed a modified cognitive control (Flanker) task followed by a survey measuring their current or recent emotional state using the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). By examining the relationship between reported positive or negative mood and error recovery, we sought to better understand the influence of emotional state on cognitive task performance. We hypothesize that participants reporting a more positive mood will show better recovery after making an error. We are currently analyzing data from 30 young adult participants to determine whether positive or negative mood predicts error recovery and pupil response. Findings from this work can provide insight into how mood shapes performance, and this can be useful to applications in contexts like academic testing, workplace performance, or high-pressure decision-making.

FIRST RECORD OF EGG GUARDING IN MOTHS:THE EFFECT OF FEMALE POSITION AND SCALES ON EGG CLUSTER SURVIVAL IN GENERALIST MOTH

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Egg guarding in insects results in higher rates of offspring survival by decreasing predation and parasitism rates of the eggs. Female fall webworm moths (*Hyphantria cunea*, hereafter FW) are frequently observed atop their egg clusters after they die, but it was unknown if this behavior is a form of egg guarding. Female FW also deposit some of their tuft scales onto their eggs as they lay them. Whether these scales also help protect the eggs (e.g. from parasitoids) is also unknown. To test if female FW egg guard and if scales help protect their eggs, we conducted a field experiment in which we pinned egg clusters to host plants in one of four FW egg cluster treatments: 1) an egg cluster uncovered with no scales, 2) an egg cluster uncovered with scales and no moth, 3) an egg cluster with scales and a pinned moth covering half the egg cluster, and 4) an egg cluster with scales and a pinned moth completely covering the egg cluster. After five days in the field, we retrieved the remaining egg clusters and examined them in the lab for evidence of predation. We continue to rear larvae to determine parasitism rates, but our preliminary results for field predation show that the presence of FW moths atop their eggs decreased rates of predation. We also found that the presence of scales may decrease predation compared to egg masses without scales. Together, our results suggest that FW may deposit tuft scales and rest atop their eggs when they die to guard them from natural enemies. Do female FW moths use egg guarding as a means of increasing the survival of their offspring? 17 replicates of 4 treatments of FW egg clusters: 1. no scales, no moth, 2. scales, no moth, 3. scales, half moth, 4. scales, moth were pinned to chokecherry (*Prunus virginiana*) host plants for 5 days at a Boulder Canyon field site. Egg clusters were then retrieved, examined for predation, and reared in the lab to assess for parasitism. From this research, we can conclude that female FW likely guard their eggs from natural enemies by resting atop them after death, but scales did not affect predation. While egg clusters with scales did not deter predation, they may affect parasitism, which we are continuing to monitor.

ASSOCIATIONS BETWEEN DEPRESSIVE SYMPTOMS AND SIBLING RELATIONSHIPS ACROSS CHILDHOOD AND ADOLESCENCE:A MULTI-METHOD STUDY

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This study examined whether depressive symptoms are related to sibling relationship quality in children (9–11) and adolescents (15–17). We used both self-report questionnaires from participants and their siblings, as well as behavioral observations from a structured interaction task. Results showed that higher depressive symptoms were linked to lower warmth and higher conflict, but only in participants' own reports, not in sibling reports. Depressive symptoms were also related to differences between siblings' reports, especially for conflict, where disagreement was greater. In the interaction task, depressive symptoms were not strongly related to specific observed behaviors like emotional expression or help-seeking, but were linked to lower overall agreement between siblings. Overall, depressive symptoms were more related to how youth perceive their sibling relationships than to observable interaction behaviors. The study explored how depressive symptoms are associated with sibling self-reported and observed relationship quality in childhood and adolescence. Relationship quality was measured during a recorded 5-minute task where participants worked with their sibling to prepare a short speech for researchers. The recordings were then coded using a lab-based system to rate behaviors like closeness, emotional support, and help-seeking. Higher depressive symptoms were linked to lower warmth and higher conflict in sibling relationships based on participants' own reports, but not their siblings' reports. Depressive symptoms were also related to more disagreement between siblings about their relationship, while observed behaviors during the interaction task were not strongly related to depressive symptoms.

FLAVORS OF HOME, VOICES OF STRENGTH:A PLACE WHERE FOOD, STORYTELLING, AND IMMIGRANT EMPOWERMENT MEET

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Cocina Libre is a Denver-based community outreach initiative that uses food and storytelling as a bridge between cultures and a tool for immigrant empowerment. Through cookbooks, community events, and collaborative engagement with immigrant chefs, the project highlights the connection between personal narratives and culinary traditions, fostering empathy, cultural understanding, and social connection. In what ways does food contribute to creating more inclusive communities and to resisting the marginalization of immigrants? The project engages immigrant chefs through community-based workshops, shared meals, and storytelling-centered activities in Denver. These interactions include collaborative cooking sessions, narrative sharing, and public engagement events that center immigrant voices. The workshops focus on food preparation, storytelling, and dialogue to amplify immigrant experiences and cultural knowledge, while creating spaces for sharing narratives and demonstrating how food can serve as a powerful tool for identity, connection, and empowerment. The project contributes to creating inclusive community spaces where immigrant stories are shared and valued, demonstrating how food can serve as a powerful tool for cultural identity, connection, and empowerment. By pairing recipes with personal narratives and facilitating shared experiences, Cocina Libre promotes empathy, challenges dominant narratives about immigrants, and strengthens community ties while supporting the visibility and economic empowerment of immigrant chefs.

LACTATE IS PROTECTIVE IN ACUTE LUNG INJURY VIA HISTONE LACTYLATION & SUBSEQUENT ACTIVATING TRANSCRIPTION FACTOR 4 ACTIVATION

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When the lungs are severely injured, the body naturally produces lactate as a signal substrate to help mediate excessive inflammation of the lung tissues. Our research found that lactate acts as a molecular switch that modifies how DNA is packaged, a process called histone lactylation. This modification shows increases activation of a protein called ATF4, which instructs immune cells to stop releasing harmful inflammatory markers and to shift towards healing. By investigating this Lactate-ATF4 pathway, we have identified a potential molecular mechanism involved in inflammation of acute lung injury (ALI).

COMMUNITY OUTREACH OF PLANETARY GEOLOGY

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This project focuses on making planetary science accessible to all ages. Mars used to have water and it made patterns into the surface. Because they were formed by water flow on the surface the patterns themselves serve as a record of that water flow. We can use this fact to extract climate information about the ancient climate. To explore this we use the physics of network growth and this occurs in everyday situations. We also explore the erosion of rivers through a small scale stream table. We seek to educate the public on planetary geology using hands on demonstrations. We used a stream table to show rover dynamics and for sand and glue and plastic to show network growth. Younger kids got to interact with a concept not on Earth in a hands on way.

RING OPENING METATHESIS POLYMERIZATION TO INDUCE FROSTER RESONANCE ENERGY TRANSFER FOR THE DETECTION OF ETHYLENE

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This project aims to develop a new method of ethylene detection. Ethylene is one of the simplest organic molecules, yet it has a wide range of applications ranging from industrial manufacturing and plastics to serving as a hormone that governs ripening in climacteric fruit. Currently many methods to quantify ethylene are restricted to laboratory settings, requiring instrumentation and trained personnel. This project aims to begin the development of a more robust system that could be used beyond laboratory settings. To accomplish this a bespoke catalyst-resin system polymerizes upon exposure to ethylene, this polymerization yields a readily observed optical response which allows for the detection of ethylene. How can ethylene triggered ring opening metathesis polymerization

be used to create a system capable of ethylene detection with an easy to read response? To complete this work novel molecules were synthesized, characterized and tested. In this work I was able to show that I could achieve polymerization and characterize the response. I have now begun working on optimizing this process and testing the effects of ethylene on the system.

HOW IS ACCESSIBILITY COMMUNICATED IN UNDERGRADUATE COMPUTER SCIENCE SYLLABI

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Computing enrollments have surged in the United States, with bachelor's degrees in computer and information sciences more than doubling over the past decade. Despite this, many computing courses remain difficult to access for diverse learners. Course syllabi shape students' first impressions by outlining expectations, resources, and support, but little research explores how accessibility and accommodations are communicated within these documents. Further, recent computing education research shows that accessibility content is often confined to HCI (Human-Computer Interaction) courses, indicating HCI teachers may have more content knowledge of accessibility than other computing educators, and perhaps be more likely to discuss accessibility in their syllabi. Toward this end, we are exploring the research question "how are accessibility policies communicated the undergraduate CS and HCI syllabi?", evaluating syllabi for three core undergraduate computing courses across eleven U.S. universities to identify patterns in the tone and information about accessibility communicated to students across different computing courses. This project provides insights into making computing and HCI education more accessible to all learners. Our main RQ is: How is accessibility offered in syllabi for Intro to Computer Science, Human Computer Interaction, and Data Structures and Algorithms courses for undergraduates across eleven U.S. colleges and universities? We analyzed HCI (Human-computer interaction), CS1 (Intro to Computer Science), and data structures syllabi from eleven well-known CS programs representing offerings from R1, public, private, not-for-profit, and liberal arts institutions. We restricted our dataset to undergraduate courses offered during the 2024 to 2025 academic year, excluding special topics, independent studies, and HCI courses offered outside of CS departments (e.g., in Psychology or Design) to ensure that our sample was reflective of computing departments' cultures and norms. Only syllabi publicly available through official institutional websites were included. We conducted an inductive qualitative content analysis using affinity diagramming, memoing, and inductive coding to develop an initial codebook reflecting the ways that accessibility policies are communicated to students in these courses. The codebook categories include whether accessibility is mentioned, where it appears in the syllabus, the specificity of details to request accommodations, tone of the language, references to disability services, and whether accessibility is framed as proactive pedagogy or primarily as formal accommodations. Our analysis identified gaps in course syllabi, such as limited attention to protecting the privacy of students seeking accommodations, unclear or vague instructions for obtaining disability support, and a lack of consideration for evolving or changing conditions that may alter accommodation needs. Based on these findings, our project proposes a set of clear, actionable guidelines to help faculty create more inclusive and effective syllabi.

THE LONELY LITTLE LADYBUG: UNDERSTANDING ANXIETY

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Through the power of storytelling my project, a children's book entitled, *The Lonely Little Ladybug*, encourages kids to explore and understand the complex worries of anxiety. It offers tips and tricks to combat their fears, and a protagonist that they can relate to. Additionally, it provides parents a method to help their children label and normalize their feelings. My project aimed to address how to adequately explain separation anxiety disorder and treatment to young children in approachable terms. I began by conducting research on the most effective treatment for separation anxiety, through children's hospital websites, the DSM-5, and published studies. I then wrote and illustrated a children's book explaining symptoms and treatment in age-appropriate terms. Given that there is an ongoing need for mental health education my book explores proven coping mechanisms for helping kids with anxiety. By providing a fun vehicle for learning an important and complex topic, it helps children feel understood.

A SYMBOLIC MODEL OF PROOF ACQUISITION IN ACT-R

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Learning to construct mathematical proofs—formal arguments demonstrating the truth of a mathematical statement using logical deductions and previously established facts—is one of the most challenging skills in STEM education. This research aims to build the foundations for a symbolic cognitive model, using the ACT-R cognitive architecture and implementing in Python with the pyactr package, to explore how different proof strategies can be thought through with only symbols and rules. The model observes simple proofs, and its abilities are assessed based on its generalization capabilities, efficiency, and error patterns. By developing and analyzing such a model, this research provides insights into how symbolic reasoning skills are acquired, offering a detailed case study of proof acquisition within a cognitive architecture. Given the foundational role of proof in advanced mathematics and computer science, it is important to consider the learner’s perspective in acquiring proof skills. This research asks: How can proof acquisition be modeled within a cognitive architecture—a framework designed to model human cognition—, so as to gain insight into both the mind of the student and the optimal strategy of the instructor? I designed and implemented a preliminary cognitive model, under the ACT-R cognitive architecture framework and in Python with the pyactr package, to observe training proofs. I evaluated the model using a three-pillar approach, which I propose for the evaluation of future, more complex models. The current, primitive model demonstrates that ACT-R can be configured to execute complete mathematical proofs across multiple proof genres, clarifies the cognitive operations and representational commitments required to symbolically step through formal arguments, and shows how proof states can be treated as dynamically evolving cognitive configurations within the mind of the learner. Although preliminary, this work establishes the foundations needed to study proof acquisition at a level of cognitive realism, opening a pathway toward models that can autonomously improve their strategies and further illuminate the psychological mechanisms that underlie formal mathematical reasoning.

VOTERS UNITED: ENGAGING YOUNG STUDENTS FOR THE 2026 MIDTERM ELECTIONS

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General trends suggest that younger and first-time voters are much less likely to participate in elections outside the national level in comparison to older voters. Midterm elections present a particular challenge for engaging voters because they have less visibility and perceived impact. The question our project seeks to answer is: how can nonpartisan, community-based initiatives effectively increase civic participation among young and first-time voters in the Denver Metro Area for the upcoming midterm elections? Through our partnership with the Denver chapter of the League of Women Voters, we distributed informational materials for voters including important deadlines, resources for absentee and mail-in voting, and descriptions of ballot issues for Colorado to various 2 and 4-year educational institutions in the Denver Metro area. We also expanded our outreach to social media, allowing us to track our engagement more effectively. Voting in midterm elections at all levels is just as important of a civic duty as voting in presidential election, but they frequently see significantly lower levels of turnout at all age levels, but especially for young voters. As a group of young voters who are invested in the democratic process, our project seeks to answer: how can nonpartisan, community-based initiatives effectively increase civic participation among young and first-time voters in the Denver Metro area for the upcoming midterm elections? Through a dozen stakeholder interviews with professors at the University of Denver and representatives from local non-profit and volunteer organizations, we learned that young voters need to be met where they are at and they need to be engaged in issues that they care about to energize them to vote. To address this need, we created informational materials that are pertinent to young voters’ needs to be distributed at 2 and 4-year educational institutions in the Denver Metro area and on social media channels. Our project is still in the beginning stages of implementation, but by the night of the showcase, we will have been able to assess the success of our informational flyer distribution (possibly through a survey) and the level of engagement in our social media campaign.

INTERPERSONAL EMOTION REGULATION FACTORS AND AI

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Interpersonal emotion regulation (IER) is a subtype of emotion regulation (ER) occurring between two people (receiver and provider) which is known to be effective in changing affect as well as promoting positive long-term outcomes. Successful IER (i.e. IER that a receiver is receptive to) is adaptive and healthy, but little is known about the contextual factors that influence whether a receiver is receptive to an IER offer. There is reason to believe that the nature of the receiver's relationship with the provider is relevant. This online study assessed receiver receptivity to a hypothetical IER offer from a romantic partner, friend, or AI chatbot in two combined samples (N = 211) of Prolific users and university students. We hypothesized that receivers would be most receptive to offers from romantic partners and more receptive to offers from friends than from AI. An ANOVA comparing receiver ratings on the offer's influence, helpfulness, validation, manipulation, and shame revealed a main effect of relationship type in that receivers were significantly more receptive to human IER offers, regardless of their relationship, than AI offers. This foundational study establishes a basis for understanding the contextual factors that contribute to IER success in common social interactions.

HETEROGENOUS NITRATION AND OLIGOMERIZATION REACTION OF BDA PROTEIN WITH URBAN AIR

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Proteins are found in the aerosol phase primarily as a component of biological particles such as pollen or spores. While proteins can promote allergenic or other effects directly, they can also undergo heterogeneous reactions to promote post-translational modification of the proteins. A heterogeneous reaction mechanism driven by gas-phase ozone (O₃) and nitrogen dioxide (NO₂) has been shown to promote both nitration and oligomerization of exposed tyrosine residues within analyzed proteins. This protein nitration modification can produce an increased IgE response in rat models, thus suggesting that proteins embedded in pollen could become more allergenic when exposed to urban air pollution. BSA (bovine serum albumin) was used as a standard protein analyte and loaded onto syringe filters, then exposed to a constant flow of ambient air through Teflon tubing. Samples were placed at the Rocky Flats North and La Casa air monitoring sites operated by the Colorado Department of Public Health and the Environment (CDPHE) in the Denver metro area of Colorado. After 2-5 weeks of exposure for each sample, the BSA protein was extracted off the filters using a PBS buffer flush and analyzed via high performance liquid chromatography (HPLC). The degree of nitration was then determined by comparing peaks produced at wavelengths of 280 nm, for unmodified protein detection, and 357 nm, for nitrated protein detection, utilizing reverse-phase chromatography. A separate analysis using size exclusion chromatography (SEC) was performed to measure the relative degree of oligomerization, however there were column complications. Previous preliminary work from the Huffman group showed the relative ratio of oligomerization to nitration increased when exposure time increased, however only a small number of samples were available for that initial set of observations. This work continues that project to observe nitration and oligomerization degrees over a wider range of exposure conditions. Nitration patterns are expressed here. How do the nitration degree and oligomerization degree of BSA proteins change with the amount of ozone and NO_x exposure? Protein samples were exposed at a CDPHE air-quality monitoring site for 2 to 6 weeks. After exposure, the samples were analyzed using HPLC (high-performance liquid chromatography) analysis to determine the nitration degree. I am currently in the process of completing HPLC and data analysis utilizing Igor.

MOLECULES FOR NEURODEGENERATIVE DISEASES

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I am a pre-med chemistry major here at DU working toward discovering organic molecules that will act as cures for Parkinson's disease. These molecules work by preventing the aggregation of large, insoluble proteins called alpha-synucleins in the brains of patients with Parkinson's disease, essentially helping to keep their brains clean and able to perform their normal functions. This will therefore slow down their neurodegeneration amongst these patients, allowing for healthier aging and better lifestyles. I am conducting my research in the Kumar Lab under Sunil Kumar, a research professor here at DU who works toward discovering cures for neurodegenerative

diseases. Working in this lab has helped me learn many principles of organic chemistry that I am able to apply to my classes. It has also helped me gain plentiful knowledge surrounding neurodegeneration and what it means to be a well-functioning brain in a chemical sense. Overall, this research will help me in my career as an undergrad in chemistry, and even later when I enter medical school. When searching for a therapy for neurodegenerative diseases, one question to be answered is what if there was a way to prevent or at least slow down further aggregation of certain problematic proteins for the sake of preserving brain function. Therefore, we are working with scaffolds with particular secondary structure that can act as foldamer/peptidomimetic inhibitors to interact with aggregation-prone regions to slow or prevent fibril formation, hopefully reducing the aggregate burden in cells in those with neurodegenerative diseases, allowing for healthier aging. I designed a 30-member library varying charge distribution, hydrophobic patterning, and H-bonding capacity to execute the synthesis, purification, and analytical confirmation, delivering well-characterized materials to the screening team on a roll-in basis. For each molecule I synthesized, I verified the data using both ¹H-NMR spectroscopy, verifying that I had the desired product by analyzing peaks representative of the molecular components of the sample, and Mass spectroscopy, to gain further data as to whether the correct molecule was synthesized by observing the peaks representative of the molecular weight of the sample. This is an ongoing project that I will continue to work on throughout spring quarter, but so far, I have achieved multiple purified NMR spectroscopies, verifying that I have synthesized a few of my desired products. For the rest of my synthetic molecules, they have been run to completion and are in the process of being worked up, optimized, and verified for further testing of their properties and whether or not they can be used as therapies.