



**Student Research Conference**

**Posters Abstracts**

**Wednesday February 16, 2022**

- Behavioral and Social Sciences
- Natural Sciences

## Behavioral and Social Sciences

**Denise Aguiluz, Antonio Romero, Taylor Duffy, Daniel Correa**, Graduate Student

*Type 2 Diabetes Threat Appraisal & Exercise-Self-efficacy as Predictors of Vigorous Exercise among at-risk Latinx Students.*

Faculty Mentor: Silvia Santos, Psychology

This study examines type 2 diabetes threat appraisal, gender, and exercise self-efficacy to distinguish between at-risk Latinx college students who engage in vigorous exercise or not. The sample included 156 Latino/as college students at risk for type 2 diabetes due to familial history. Participants were predominantly female (66%). The total sample was considered overweight based on BMI. A multiple regression was run to predict vigorous exercise from three threat appraisal variables: perceived diabetes risk, perceived threat, and genetic risk. Gender and exercise self-efficacy were also expected to predict vigorous activity in the analysis. The overall model was significant [ $F(5, 146) = 10.80, p < .001$ ], and the predictors accounted for 27% of the variance of vigorous exercise. Gender and exercise self-efficacy were significant predictors of vigorous exercise. Men engaged more in vigorous exercise compared to females. Participants with higher levels of self-efficacy engaged more in vigorous exercise. Threat appraisal variables were not significant in the model. Then, a binary logistic regression was performed to identify if gender and exercise self-efficacy predicted who met federal guidelines for vigorous exercise of a minimum of 60 minutes per week versus who did not. The overall regression equation was significant and provided a good fit for the model,  $\chi^2(2) = 31.89, p < .001$ , Nagelkerke  $R^2 = .247$ . Exercise self-efficacy was found to be a significant predictor of vigorous exercise. With everyone unit increase in exercise self-efficacy, the odds of being classified as “meeting federal guidelines of vigorous exercise” was 2.92 times greater than the odds of being classified as “not meeting federal guidelines of vigorous exercise.” Gender was not found to be significant in this model. Future college interventions should focus on promoting exercise self-efficacy to lower the onset of type 2 diabetes among at-risk Latinx college students.

**Madison Reyna**, Graduate Student

*Retrospective Self-Reports of Parental Monitoring*

Faculty Mentor: Carl Sneed, Psychology

With the increased accessibility of technology, parents have had to modify their ways of monitoring to adapt to the widespread use of technology among their children. However, very little research has been conducted on parental use of technology for monitoring the behavior and location of their children. Therefore, the purpose of the current study is to examine attitudes toward the use of technology for parental monitoring and gather information from retrospective self-reports of parental monitoring. This study contains an exploratory analysis as no assumptions were made about students' past behaviors. A sample of 114 CSUDH students completed an online survey that contained questions relating to their adolescent experiences. Specifically, questions regarding opinions on parental behaviors, perceived parental self-efficacy, parental psychological control, resilience, and demographic questions relating to their personal background and home life. Most participants were female, first-year students between the ages of 18-19 years old and of Hispanic/Latinx ethnic background. The current study found that on average, participants did not agree with parents using technology to monitor their children. Additionally, most participants reported their parents did not track their location while they were adolescents. Furthermore, there was a positive correlation between parental monitoring and parental monitoring with technology ( $r = .22, p = .02$ ) indicating that participants who reported more parental monitoring were also likely to report more parental monitoring with technology. These findings suggest that although parents have access to technological means to monitor their children, most parents are not utilizing them.

**Belen Guillen, Tristan Ayoubi, Dominique Hall, Antoya Graham** Graduate Student

*The Trajectory of Research of COVID-19's Effect on Working Populations*

Faculty Mentor: Ashley Membere, Psychology

The aftermath of the COVID-19 pandemic and subsequent shut down left damaging impacts on the workforce that has been researched extensively. However, there has been previous criticism of the lack of representation in work and management research samples (Bergman & Jean, 2016) that led us to question what populations are being represented in these studies. Many historically underrepresented populations were impacted during the COVID-19 pandemic, including people of color and the working class. To locate studies, student researchers used a 'covid-19 or coronavirus or 2019-ncov or sars-cov-2 or cov-19' search string along with journal names in PsycInfo, Business Source Premier, and Academic Search Premier. Searches were also performed directly on journal websites for articles published up to October 2021. We then saved results in Zotero, for later pruning. 741 articles across 50 journals in industrial/organizational psychology and management were narrowed down to 388 articles using Nvivo to only include articles that mentioned COVID-19 in the abstract and/or keywords. We have 125 articles categorized as research about the impact of COVID-19 on the workplace that will be analyzed further. 77 articles collected data and 48 are review/commentary articles. For future analysis, the research team will read the full text of the 125 articles and categorize them based on a number of characteristics: type of sample (e.g., retail workers, healthcare, management), country of data collection, demographics of sample (e.g., gender, racial composition), and outcomes measured (e.g., physical, psychological, social, family). These categorizations will allow us to assess if COVID-19 research within I/O psychology and management fails to focus on the effects of the pandemic on those who are most impacted. Following this, we can create a series of recommendations to researchers on how to address our gaps of knowledge about the effects of COVID-19 for understudied samples.

**Miguel Palacios,** Graduate Student

*Differences in Social Support and Mental Health Among Urban College Students*

Faculty Mentor: Giacomo Bono, Psychology

Urban universities have been essential to helping young adults achieve life goals and increasing the social mobility of the students and the communities they serve. Unfortunately, due to the COVID-19 pandemic, the students and communities these urban universities serve now need to contend with new challenges that compounded the stress of many students, especially underrepresented minorities who were disproportionately harmed by the pandemic. The purpose of this study was to look at the resilience and mental health (levels of anxiety, stress, and depression) of college students at California State University, Dominguez Hills (CSUDH) during the pandemic. We were specifically interested in looking at social support as a predictor for resilience, stress, anxiety, and depression symptoms. This study was a longitudinal study that took place at CSUDH. It started during the 2020 fall semester and went through the 2021 spring semester. There were four-time points: the start of the 2020 fall semester, the end of the 2020 fall semester, the beginning of the 2021 spring semester, and the end of the 2021 spring semester. There were (n = 341) participants taken from psychology and business courses from CSUDH. Data was collected from Alchemer and once the participants finished, they were awarded credit for their course. We predict that individuals with high social support will exhibit higher levels of resilience compared to individuals with little to no social support (PeConga et al., 2020). We also predict that individuals with low levels of social support will experience higher levels of stress, anxiety, and depression compared to individuals with high levels of social support (Wasserman et al., 2021). We plan to run ANOVA's to examine the differences between individuals with high social support and individuals with low social support.

**Marissa Wenzell**, Graduate Student

*Grit, Academic Function, Academic Harm, Resilience, and SES During the COVID-19 Pandemic*

Faculty Mentor: Giacomo Bono, Psychology

During the COVID-19 pandemic, the academic function of college students has been harmed due to various global and personal circumstances. The definition of grit has existed for over a decade, but recent research suggests that in addition to consistency and perseverance with respect to goals, grit also includes adaptiveness with goals (Datu et al., 2017). Further, these researchers found that adaptability function of grit predicted academic and career development self-efficacy among college students. Bono et al. (2020) found that academic harm from the pandemic was higher for lower SES students than moderate SES college students, but grit was related to more resilience and well-being and marginally less academic harm from the pandemic. The current study builds on this by examining if grit is protective of academic functioning by contributing to more resilient responding to the pandemic. An online survey including questions pertaining to grit, academic functioning, resilience, and SES was sent to college students at the beginning of the Fall 2020 semester and the end of the Spring 2021 semester. A sample of 85 students was obtained. It consisted of 23 (27.1%) men and 62 women (72.9%) ranging in age from 18-55 years ( $M = 20.67$ ,  $SD = 5.27$ ). Bivariate correlations were used to gather preliminary results. Academic harm from the pandemic was negatively correlated with grit and with resilient responding to the pandemic at both Time 1 and Time 2. For the current study, multiple linear regression analyses will be used to better explore the relationship between academic function and grit. Specifically, mediation will be used to see if resilience mediates the relationship between academic harm and grit, and moderation will be used to see if SES moderates the relationship between academic function and grit. Implications for supporting college students in the aftermath of the pandemic will be discussed.

**Jennifer Marie Correa, Nasim Karimi, Christian Riley, Julissa Magana**, Graduate Student

*The Impact of COVID-19 On CSUDH Students*

Faculty Mentor: Steven Freeze, Psychology

The COVID-19 pandemic rapidly spread around the world, causing massive disruptions to everyday life and in some cases resulting in irreparable harm. The Center for Disease Control and Prevention (CDC) has declared a grand total of over 51 million COVID-19 cases and an ongoing death count of over 800,000 people in the United States. College students are one of the hardest hit populations who struggle to maintain their previous level of functioning achieved prior to the pandemic. Routine activities for students such as attending class became difficult, sometimes overwhelming, during the remote learning environment. Coursework, which must be achieved, has become increasingly complicated as students cope with isolation, address stress and attempt to stay focused on their personal and professional objectives. This study will examine how COVID-19 has impacted student issues ranging from the academic environment (including student perceptions of campus resources), the management of stress, social networking, adjustments to value systems, and hopefulness and resilience. The survey questionnaire will obtain information on a variety of everyday measures including the emotions experienced by students during this period (the PANAS-X scale will be employed). One of the primary objectives of this research is to illuminate students' experiences during the period of time when classes were operated primarily through remote instruction. This study will also consider which campus resources were perceived as available and helpful to students. It is hoped that the findings from this study will enable all constituents in the university community to better prepare for and improve their ability to respond to future crises. The project is in the final stages of development and will be submitted to IRB in the early Spring.

**Lindsey Washington**, Graduate Student

*Educator Burnout in Underserved Communities: Examination of Family and Workplace Social Support*

Faculty Mentor: Monique Willis, Marital and Family Therapy

Educator burnout is prevalent with harmful effects on teachers and educational systems across the United States. Teachers who experience “burnout” may encounter a range of negative symptoms, including feelings of energy depletion and exhaustion, mental distance from their professional role, and ineffectiveness and lack of accomplishment. For example, according to a 2021 State of the U.S. Teacher Survey, 75 percent of teachers reported frequent job-related stress compared to 40 percent of other working adults. In addition, of those surveyed, 27 percent of teachers reported symptoms of depression, and 25 percent of teachers shared they were likely to leave their jobs by the end of the 2020-2021 school year, post-COVID-19 (Steiner & Woo, 2021). Furthermore, inner-city teachers experience high levels of burnout due to unique factors evident in underserved communities. In these instances, educators in these communities bear the weight of achievement gaps between students of color and their White counterparts, challenges of community adversity, systemic oppression, and a lack of adequate resources (Farber, 1998). Currently, there is a lack of research concerning how inner-city teachers can remedy their burnout levels amid these additional factors. Studies on social support suggest the importance of teachers’ interpersonal relationships and social support from their family system. More importantly, school leaders can aid in lessening the effects of burnout even among inner-city educators. Specifically, McCormick (2019) suggests that money allotted to mental health services for educators in an underserved community can decrease teacher turnover rates and increase teachers’ patience, which positively impacts students’ mental and emotional well-being and academic performance. This study continues to add to the body of literature on inner-city teachers. It will further explore teachers’ experiences in a city in Los Angeles County social support (both familial and school staff support). Additionally, the research will look at the implications that having social support might have on these teachers’ burnout rates and levels of stress.

## Natural Sciences

**Kevin Quezada Alvarez**, Undergraduate Student

*Analysis of the Importance of ycfM, hofM, and iraD for Escherichia coli’s Survival in Long Term Stationary Phase*

Faculty Mentor: Karin E. Kram, Biology

The bacterium *Escherichia coli* can survive for long periods without additional nutrients in a growth phase called Long Term Stationary Phase (LTSP). LTSP allows us to use the laboratory to imitate *E. coli*’s natural environmental conditions more closely. During this phase, the bacteria adapt to multiple growth and death cycles, along with changes in nutrient levels and composition accompanied by other stressors. This phase has only recently been examined, which means the genes responsible for the ability to survive in these conditions are not completely known. To understand which genes are needed for the cells to adapt and survive, competitions between wild-type (WT) & mutant ( $\Delta$ hofM,  $\Delta$ ycfM,  $\Delta$ iraD) strains were performed. hofM is responsible for the utilization of DNA as the only source for carbon and energy and iraD helps to regulate the transition from log phase to stationary phase. Through competitions, we have shown that these genes do not have any effect during LTSP when deleted from the *E. coli* genome, even though they were previously identified as possible targets. However, the strain missing the gene ycfM, which helps to generate peptidoglycan in the cell wall of the bacterium, was outcompeted by WT during competition. This means that the ycfM gene is important for survival in LTSP when competing against the WT strain. Further research will determine why ycfM has this effect and will also help identify other genes that are important in LTSP.

**Kevin Mosqueda, Kelsie Kaufman, Raven Nolasco**, Undergraduate Student

*Pervasiveness of Microplastics in the Southern California Bight*

Faculty Mentor: Samantha Leigh, Biology

Microplastics (MPs) are a growing issue that needs to be addressed in the same respect as macroplastics as they pose dangers to marine life. Given they are still largely understudied, this research aims to study the number and types of MPs in water and zooplankton (a primary food source for many marine organisms) samples in the Southern California Bight. From the data analysis (using averages, ANOVAs, and standard deviation), it was found that fibers were more abundant than particles in all samples and water samples had more MPs in general. For instance, Palos Verdes had the greatest amount of MPs present in plankton samples, yet the least in water samples. Additionally, two types of fish, the Northern Anchovy and California Halibut are currently being dissected to take a look at selective tissues. In the future, these tissues will undergo MP extraction to analyze the quantity of MPs present and to discover how many MPs are being transferred from zooplankton to the fish that eat them.

**Jocelynn Mena**, Undergraduate Student

*Identifying if ycfJ, yqgB, malZ and tfaS Play A Role in Long-Term Stationary Phase in Escherichia coli*

Faculty Mentor: Karin Kram, Biology

*Escherichia coli* can survive long periods of time by adapting to live in stressful environments. *E. coli* enters a long-term stationary phase (LTSP) when it grows in an environment where nutrients are scarce; this is one of the five phases in bacteria's life cycle. After "stationary phase", over 99% of the cells die. The remaining cells survive into LTSP, which can be used as a proxy for a more natural environment in the lab to observe how cells adapt to these conditions. The genes which may be important to survival or adaptation in this phase are mostly unknown. Previous work in the Kram Lab screened through a collection of *E. coli* strains missing one gene each and identified a total of 101 gene deletions that affected the cell's ability to survive in long-term cultures when competing with wild-type strains (those that have the gene). To confirm that these genes actually play a role in survival, I compared the effect of the genes ycfJ, yqgB, malZ and tfaS in competition with wild-type *E. coli*. We found that the deletion of yqgB had no effect on growth of *E. coli* while competing with wild type. The strain missing ycfJ was outcompeted by the wild type. ycfJ is activated upon biofilm formation and is involved in flagellar synthesis, swarming, and cell elongation. The strain missing malZ is greatly outcompeted by the wild type as well. malZ is involved in maltose metabolism. The strain missing tfaS, is greatly outcompeted by the wild-type strain. These data confirm at least three genes from the initial screen are important for survival in LTSP when competed with wild-type strains... Our continued research will help to determine why these are essential for survival into LTSP by determining their function in long-term cultures.

**Marialuisa Flores-Jacobo**, Undergraduate Student

*Invasive Plant Species Exhibit Population-level Differences in Phenotypic Plasticity in Response to Nitrogen Availability*

Faculty Mentor: Justin Valliere, Biology

The invasion of non-native plants is a leading cause of habitat loss and a major threat to our economic and environmental sustainability. The constant input of nitrogen pollution into our environment and climate change also play a key role in the degradation of native plant communities. Our project aimed to explore and understand the impact nitrogen deposition (due to air pollution) and climate have on two widespread invasive plant species of Southern California. In a common garden pot experiment, we compared the growth and functional traits of multiple populations of these species using plants grown from seed collected from 12 field sites that experience different levels of nitrogen deposition and aridity. For the experiment, half of the plants received added nitrogen and the other half did not. Using data from this plant growth study, we evaluated the influence of nitrogen and climate on invasive plant traits and their phenotypic plasticity, including for phenology, growth, and reproduction. Our overall research goal was to understand if site-level variables (climate and nitrogen deposition) play any major role in driving plant invasiveness, independently or in conjunction with one another.

Preliminary results strongly suggest that both species evaluated exhibit population-level differences in phenotypic plasticity in response to nitrogen availability. These responses may be driven by local adaptation in these populations to nitrogen deposition and climate. This work highlights how problematic plant invasives may respond to evolutionarily to environmental conditions, which could contribute to their invasiveness.

**Mayra Hernandez**, Undergraduate Student

*Exploring the Impacts of Multiple Anthropogenic Stressors on California's Coastal Sage Scrub*

Faculty Mentor: Justin Valliere, Biology

Dramatic changes in climate, soil nitrogen (N), and wildfire regimes in southern California are shifting the abundance and composition of vegetation – increasing invasive species and reducing native biodiversity. N deposition, the input of N from the atmosphere to ecosystems, is increasing due to air pollution. Although N is necessary for vegetation, it can be detrimental to ecosystems when extreme levels are present. Likewise, plant communities native to southern California's Mediterranean-type climate have evolved to thrive under historical wildfire conditions. However, increasing occurrences of fire can shift the plant composition, to the point of converting to invasive-dominated grasslands. Global change-type droughts have also altered the conditions under which vegetation survive and extreme drought may exacerbate the impacts of other stressors. To identify and quantify the effects of these potential anthropogenic stressors on southern California's coastal sage scrub species, we conducted a field N addition experiment at Deer Creek Canyon Park within the Santa Monica Mountains, a site which naturally experiences low levels of N deposition. To explore potential impacts caused by N deposition, a gradient of soil N availability was created by adding N at two levels corresponding to levels of N deposition under moderate and high levels of air pollution. Control plots received no N addition. Vegetation was monitored from 2012 to 2017 during which the site experienced an intense drought and the 2013 Springs Fire, allowing for observations on the effects of N addition on post-fire recovery. Data on community composition, shrub cover and resprouts, and soil N was statistically analyzed through R. Preliminary results of this long-term field study suggest N addition may alter community responses to drought and fire. Information on potential interactions between multiple anthropogenic stressors may provide applied ecologists with a better understanding of future vegetation patterns in southern California shrublands under continued environmental change.

**Ruben Lopez**, Undergraduate Student

*The Importance of the Genes *bdm*, *phoP*, and *sdhE* in Long-Term Stationary Phase in *Escherichia coli**

Faculty Mentor: Karin Kram, Biology

*Escherichia coli* goes through five phases in its life cycle: lag, log, stationary, death, and long-term stationary phase (LTSP). In the laboratory, we use LTSP to mirror a more natural environment where the bacteria must adapt in order to survive. Through previous work, the lab has identified a number of genes that may be important to the LTSP. The goal of this project is to determine the importance of each identified gene and deepen our understanding of LTSP. To achieve this, a knockout mutant strain of *E. coli* missing one of the previously identified genes was made and competed against the wild-type strain of *E. coli* in LB media. Over the course of ten days, the culture was closely monitored by determining cell counts of each strain (the mutant and wild type), to obtain a growth curve. We have observed that the strain missing *sdhE* or *phoP* underperforms in LTSP compared to wild-type strains. The strain missing *bdm*, on the other hand, outcompeted the wild-type strain in our experiment. The gene *sdhE* helps the cell to use succinate as a carbon and an energy source. *phoP* is a dual transcriptional regulator that activates multiple genes involved in behaviors like:  $Mg^{2+}$  homeostasis, resistance to antimicrobial peptides, acid resistance, and LPS modification. *bdm* stands for biofilm dependent modulation and is involved in regulating flagellar biosynthesis. The data indicates that all three genes affect LTSP; *sdhE* and *phoP* are essential for survival (without them, cells die in LTSP when competed with wild-type strains) and the loss of the *bdm* gene actually gives the mutant strain an advantage in LTSP, indicating its presence may hinder survival. Further work will help to understand the complexities of LTSP, and the role of these genes in adaptation to this environment.

**Susana Lopez-Ignacio**, Undergraduate Student

*Rare Species in *Encelia**

Faculty Mentor: Sonal Singhai, Biology

My research focuses on two rare species in the desert plants *Encelia*, *Encelia ravenii* and *Encelia densifolia*. The rare species of *Encelia* are primarily found in certain spots of Baja California. We define “rare” on how limited its geological range is and the low population density the plant has. The desert flora has a very small population and at specific locations one can count each individual rare *Encelia* by hand. *Encelia*, as well as many other desert plants, go through a process called “seed-banking”, which is when seeds are present in the soil and they will remain there until germinated. This and other factors, ecological or genetic, could be the reason why *Encelia* is slowly diminishing. There are 15 species of *Encelia*, and we are analyzing genetic data from 10 species. We are determining if there is a difference in genetic variation and diversity between the rare and non-rare species. We hope to understand if rarity reduces genetic diversity in these plants, thus putting them at increased risk for extinction.



**Joie Luna**, Undergraduate Student

*Urban Coyote Project at CSUDH: Using Urban Ecological Research to Guide Wildlife Management*

Faculty Mentor: Justin Valliere, Biology

Coyotes' populations have been increasing in highly urbanized areas, including in the greater Los Angeles area. In 2020 the CSUDH campus community noticed a high amount of coyote activity and brought it to the attention of the Office of Risk Management. Coyotes have been known to inhabit the campus and surrounding area but due to Covid-19 their presence was more noticeable with less staff and students on campus. As part of Professor Valliere's spring 2021 Ecology course, we aimed to determine when and where coyotes were active on campus and what food sources coyotes were utilizing. In order to evaluate coyote activity and abundance, we installed a network of nine camera traps in different locations across campus and analyzed the captured images for wildlife activity. We identified all species observed and recorded the location, data, and time into a spreadsheet. The most frequent species observed was the desert cottontail rabbit, coyotes, and rats. Across all locations we recorded about 400 individual sightings of coyotes. The coyotes were active all day, but activity peaked in the late afternoons, evenings, and early mornings. To analyze coyote diets, we collected scat samples from Heritage Creek and dissected and weighed the samples to determine the food sources coyotes were eating. We separated samples into different food sources including, plant seeds, insects, mollusks, bones, fur, and anthropogenic food sources (e.g., trash). We determined that the coyotes on campus mainly ate small mammals, since fur and bones were the largest proportion of mass and the most frequently present food sources in samples. We continue to recommend further monitoring, proper signage, education about the coyotes, and proper landscaping in order to manage campus coyotes. With education and proper landscaping, humans and coyotes may be able to safely coexist on campus.

**Mikaela Gil**, Undergraduate Student

*Playing with Fire: Potential Benefits and Risks of Prescribed Burning for Grassland Management in California*

Faculty Mentor: Justin Valliere, Biology

Prescribed burning is a tool that can be used by land managers to promote and enhance growth of native vegetation, control invasive species, and reduce fuel loads that contribute to wildfires. This management strategy has been suggested as a particularly useful tool in preserving California's native bunchgrasses, and it is often assumed to benefit these species. However, while prescribed burning has been used in California's grasslands for years with some observed success, little is known about the specific effects this method may yield, and published research has shown inconsistent effects for both native and non-native species. We conducted a literature review and collected data on effects of prescribed burns in California with the goal of identifying when, where, and how prescribed fires may be beneficial. This review considered articles that used prescribed burning across California, in different seasons, for various target native and non-native species, and with different burn frequencies. By synthesizing these results, we aimed to determine the number of studies evaluating this method, the species for which it has been tested, and how prescribed burning could be a solution for land management. We found promising evidence in some studies that had performed prescribed burning across different seasons and over multiple years. However, other studies showed variable success for invasive species control and enhancement of native species, which could be due to differences in site conditions, timing of burns, and species composition. We concluded that prescribed burning does show promise as a management tool, but more research is needed, especially long-term studies across different seasons and sites in order to develop accurate recommendations for when and where land managers can utilize this technique for preserving California's rich grassland biodiversity.

**Isabel Parada**, Undergraduate Student

*Oenothera Pallida ssp. Pallida are an Important Species for Testing Genetic Diversity and Breeding Systems.*

Faculty Mentor: Kathryn Theiss, Biology

Oenothera is used for medicine in form of herbal supplements either in oil supplements or seed oil for treating inflammatory-related disorders such as eczema and rheumatoid arthritis and alternative medication for diabetes. Climate change can affect the evolution of Oenothera by influencing the timing of fertilization and adaptation to the biogeographic condition. This group needs to have the ability to adapt to an extreme environment with its genetic diversity and morphological variation.

Oenothera pallida ssp. pallida are pollinated by hawkmoths and sometimes bees and grow in exposed sand dunes from Washington to Utah. Our previous research shows that Oenothera pallida ssp. pallida are extremely variable with regard to the breeding system, and it is dependent on the maternal plant. However, these previous experiments sampled only 13 plants across three populations, limiting our success in the testing breeding system using hand pollination. Our goal for this year is to get 15 plants per population to be used for experimentation.

We obtained seeds from 12 populations of Oenothera pallida ssp. pallida from across its complete range. We are starting to germinate these seeds in the Spring of 2022 with a goal of having 15 plants per population to test for the breeding system. After conducting the breeding system experiments, we will use genetic markers to follow the inheritance patterns. We expect to find variation in breeding systems across the populations and the usage of the genetic markers will allow us to correlate overall genetic diversity with the breeding system.

**Gavin Acosta**, Undergraduate Student

*A Survey of Constructed and Simulated Molecular Knots*

Faculty Mentor: Carolyn Yarnall, Mathematics

In regard to the field of topology, knots are similar to their shoestring counterparts with one major difference; there are no ends, the loop is closed. These knots can be classified by their number of crossings. Knots can be manipulated to reduce the number of crossings present, but it must be done without severing the strand in question. The purpose of our study into knots is to see if any particular patterns exist amongst the knots present within certain molecules.

We are going to examine molecular knots, both physical and simulated, and categorize them by their properties. Their knot properties such as number of minimal crossings, actual crossings, strands, and templates, as well as their chirality (topological), and more will be taken into account. Their chemical properties will also be taken into account, such as the number of atoms, elements present, and chirality (chemical). Models of these knots will be manipulated to demonstrate a relationship between these properties, such as the number of strands and templates. Any noted patterns will be presented.