

2020 - 2021

SENIOR RESEARCH BOOKLET

Letter from the Director



Dear friends,

It is my pleasure to introduce and congratulate this year's impressive group of University Honors Program (UHP) students who have completed their signature capstone theses and independent projects. The work represented here reflects the culmination of hard work and creative and critical thought that highlights their undergraduate education. Our students have contributed to the research enterprise and creative spark of this great public research University. I still have a copy of my undergraduate honors thesis, and I remain very proud of that work to this day. Thus, a capstone is a collective point pride for family and friends and an individual accomplishment that UHP students can draw upon as they transition to professional and graduate schools or embark on their new careers.

It is notable to see the breadth of work represented here, from how psychedelic drugs might be harnessed to treat certain mental illnesses to how the nation's founders and the tenets of the Constitution were influenced by Roman political thought to advances in health care education at student run clinics towell, virtually all disciplines at the institution are well represented in this collection. It is a distinctive feature of a UC Davis honors education that students from such a wide range of majors, and from a very diverse set of personal backgrounds and lived experiences, are part of this close community of scholars, and this is beautifully represented in these pages. As you peruse the abstracts, you will notice several projects that were completed on subjects outside the student's primary major, or that intentionally blended multiple disciplines. This too is encouraged by our program, and it is the students who fully embrace the ability to communicate and work effectively across disciplines and understand multiple perspectives who will be our best problem solvers and difference makers.

In closing, I want to recognize the faculty mentors who lent their valuable time and expertise to help guide (and often times fund) this work. I know that our students are grateful for that critical, multiyear mentorship. I also wish to recognize the hard work of our UHP staff, serving as advisors, confidantes, and at times cheerleaders as the students complete this last significant piece of their UHP journey. The Undergraduate Research Center staff are our valued partners in helping students connect with faculty mentors and showcase their work at the Undergraduate Research, Scholarship and Creative Activities conference each Spring. Likewise, our Engineering majors benefit from the support of their College as they present their capstone work at the Senior Design Project Showcase. Lastly, this booklet was produced with the design expertise of our UE communications team, working closely with the UHP staff to assemble this nice recognition of our students' research, scholarship and creative work.

It is truly a privilege to serve as Director of the University Honors Program and to support the exceptional achievements of our students through their capstone experiences, across the many disciplines represented in the program. Our students have discovered and created great things already, and will continue to contribute to society as researchers, thought leaders and engaged citizens, and as our newest alumni of UHP and UC Davis.

Sincerely,

J. David Furlow
Director, University Honors Program

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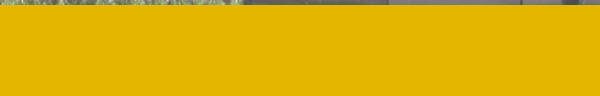
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College of Agricultural and Environmental Sciences



| Cameron Alexander |

Major: Human Development
Minor: Psychology and Education

Mentor: Dr. Nicole Sparapani

Research Type: UHP Thesis

Preliminary Validation of an Observational Measure of

Emotion Regulation for Individuals with Fragile X Syndrome

Emotion regulation (ER) is the combination of physiological, behavioral, and emotional states that provide the tools needed to adapt through everyday situations. Studies often measure ER using rating scales completed by a caregiver, potentially resulting in biased representations of ER. This study aims to examine the construct validity of an observational measure of ER outlined in the Classroom Measure of Active Engagement (CMAE). Participants included 28 males with Fragile X Syndrome between the ages of 15-22 who were recruited for a longitudinal study at the UC Davis MIND Institute. As part of the larger study, video observations of the Autism Diagnostic Observation Schedule (ADOS) were collected, and parents completed a battery of questionnaires to measure anxiety and behavior. Three trained raters coded ER using the ADOS observations; interrater agreement was high (88.87%). Findings indicated significant, positive correlations between emotion dysregulation and salivary alpha-amylase (sAA) readings ($r = 0.622$; $p < 0.01$), suggesting an association between ER and psychosocial stress expressed by the sAA recordings. The associations between ER with anxiety and behavior were not significant. These findings offer preliminary support for the validation of the ER construct outlined on the CMAE, and substantiate the role of physiological arousal in ER.

| Claire Chapman |

Major: Global Disease Biology
Minor: Medical-Veterinary Entomology, Public Health

Mentor: Dr. Chris Barker

Research Type: Honors Thesis in Major

Thermoregulation of *Aedes aegypti* mosquitoes

Temperature plays an important role in mosquito physiology; like many insects, mosquitoes are ectotherms and must behaviorally thermoregulate to avoid temperature extremes and remain at physiologically suitable temperatures. Behavioral thermoregulation also plays an important role in mosquito-borne virus transmission dynamics by altering the extrinsic incubation period, the time from ingestion of the virus to transmission. However, few studies have been conducted on mosquito behavioral thermoregulation outside of host-seeking behavior. This study will be one of the first to elucidate temperature preferences of the mosquito *Aedes aegypti* during the critical period from blood feeding through the extrinsic incubation period. We will use a thermal gradient bar with an enclosed Plexiglas arena in a temperature and humidity controlled chamber, providing the mosquitoes the option to land on a metal surface ranging from 18°C to 37°C. Mosquitoes will be placed in the arena and pictures are taken remotely at regular intervals. We will analyze these pictures to quantify the changes in resting behavior as the blood meals are digested. The results we find will help us better understand *Aedes aegypti* viral transmission and population dynamics. complex mammalian breeding systems.

| Elizabeth Anderson |

Major: Animal Science
Mentor: Dr. Matthias Hess

Research Type: Honors Thesis in Major

Evaluating the Impact of Agricultural Waste Products on Enteric Methane Production in vitro

Ruminant livestock production is a major contributor to anthropogenic greenhouse gas emissions, particularly in the form of enteric methane (CH₄) production. Enteric CH₄ is the result of microbial fermentation of feed within the foregut of ruminant animals. One promising strategy to reduce enteric CH₄ without compromising animal productivity is the dietary addition of plant material with anti-methanogenic properties. In recent years some agricultural byproducts, such as grape and pomegranate pomace, have shown CH₄ mitigation potential. In addition to reducing overall CH₄ emissions, rerouting agricultural waste from the landfill into animal production systems would reduce both total feed costs for livestock producers and the environmental footprint of food production.

| Annaliese Divney |

Major: Global Disease Biology
Minor: Human Rights

Mentor: Dr. Cassandra Swett

Research Type: Honors Thesis in Major

***Fusarium falciforme* as a possible novel pathogen of the Sweet Bell Pepper (*Capsicum annuum*)**

Recently the Swett plant pathology lab at the University of California, Davis has received infected bell peppers which were determined to be infected with *Fusarium falciforme*, a member of the *Fusarium Solani* Species Complex (FSSC). Although certain members of the FSSC are known to be pathogens of bell peppers found in areas such as the United Kingdom and Canada, in California there has never been a recorded case of a member of the FSSC as a stem rot pathogen of bell peppers. Additionally, *F. falciforme* itself is not a recorded pathogen of bell peppers anywhere in the world. Bell pepper production is important to national and local economies, and thus the pathogens that cause disease and crop loss in bell peppers are important areas of study. This experiment uses Koch's Postulates to test the pathogenicity of *F. falciforme* on bell peppers.

| Benjamin Elliott |

Major: Food Science
Mentor: Dr. J Bruce German
Research Type: UHP Thesis

An Analysis of Plant-based Volatile Compounds and their Precursors to Mimic the Umami Flavor of Meat

Humans are innately drawn to the flavors and aromas in meat. We crave it, the thought of it makes our mouths water. But what is the “it” factor in meat that makes it so irresistible, and why do humans continue to choose meat from animals over the plant-based alternatives available on the market today. Flavor is incredibly complex and is linked with many different compounds and their interactions with one another. This paper researches the volatile compounds and flavor molecules, as well as their precursors, that make meat desirable. The source of the fat, whether from an animal or a plant, makes a difference in the flavor compounds produced during the cooking process. This paper looks at plant-sourced fats that may produce similar compounds when cooked to the ones found in meat. The Maillard reactions that cause browning in meats are greatly impacted by the amino acid content. Exploring the amino acid contents of plant-based foods that have meat-like umami flavor, such as mushrooms, nutritional yeast, and soy in comparison with those of meat products, could lead to the discovery of what makes meat delicious.

| Tara Falt |

Major: Animal Science
Mentor: Dr. Amy McLean
Research Type: UHP Thesis

Pilot study comparing blood concentrations and pharmacokinetics of Flunixin Meglumine oral, injectable and transdermal in donkeys (Equus asinus)

Recognizing signs of pain or discomfort in donkeys can be difficult due to both their natural instinct to mask signs of weakness as well as their “stoic” demeanors. Even when their pain is identified, donkeys are not always cooperative when it comes to accepting treatment. They are known to hide medication in their mouths and their thicker cutaneous colli muscle makes intravenous drug administration especially difficult. One common analgesic, Flunixin Meglumine (Banamine), is available in an injectable, oral, and more recently, a transdermal form. Proven effective in cattle, this new cutaneous mode has the potential to be a safer and more manageable alternative to administering flunixin. The specific aim of this study is to compare the pharmacodynamics and pharmacology of three routes of flunixin in donkeys (e.g. oral, injectable, dermal). Six donkeys will be used in a three way crossover design in which blood samples will be taken over a 96-hour timeframe for determination of drug and eicosanoid concentrations. The results from pharmacokinetic analysis will be evaluated using appropriate statistical methods. This study could be the first step towards proving that the dermal version of Flunixin Meglumine can conveniently and effectively improve the overall wellbeing of donkeys.

| Mikaela Fenton |

Major: Community & Regional Development
Minor: Spanish and Technology Management
Mentor: Dr. Noli Brazil
Research Type: UHP Thesis

Models of Workforce Affordable Ownership Housing Over Time

California is facing a housing crisis. One group that has been highly affected has been the workforce of moderate-income citizens who often have to contribute over 30% of their income towards housing expenses. To answer the question of how best affordable ownership housing programs can serve this group, I analyzed four different models of affordable housing compared to market rate ownership and rental models in the City of Davis. This included Dos Pinos (limited equity housing cooperative), Aggie Village (limited appreciation land trust model), Southfield Park (limited appreciation condo), and the City of Davis Affordable Ownership Housing Program (limited appreciation single family homes). I compared the level of affordability for each model from the year the model was first implemented in Davis, to their status in 2019. I found that while each model of affordable ownership housing was less expensive than the comparable market rate option, certain models were more effective at producing affordable prices as well as increasing affordability over time. These differences should be recognized, and the most effective models should be implemented in future plans for creating affordable workforce housing.

| Lili Girodie |

Major: Environmental Policy Analysis & Planning
Minor: Sustainability in the Built Environment
Mentor: Dr. Majdi Abou Najm
Research Type: UHP Project

Life Cycle Analysis on a Residential Building Scale

As greenhouse gas emissions continue to rise, and the earth continues to warm, it is vital that we do the best we can to limit our impact on the earth. This is especially important when it comes to new, residential development. In order to know the true impact that a project will have on the environment, we need to consider the entire building and all of its individual components from its construction to its demolition, via Life Cycle Assessment (LCA). The Leadership in Energy and Environmental Design (LEED) framework is an internationally recognized, comprehensive point-based rating scheme that allows us to assign a sustainability score to the building(s) under review. Although the LEED framework allows us to analyze and improve on our sustainability in many ways, I believe that there are some major gaps, especially where a thorough LCA is concerned. As such, I propose that a modified building assessment model be created that includes additional facets of LCA. Additionally, I propose that LCA be expanded to consider the water-energy-food nexus that is instrumental in accurately understanding building sustainability in the residential sector.

| Nicole Gonzales |

Major: Animal Science
Mentor: Dr. Michael Mienaltowski
Research Type: UHP Thesis

Inhibition of Glycolysis to Promote Tendon Formation

Proper tendon healing can be the difference between an active horse and a debilitated horse. Advancements in repair strategies are required to improve tendon healing in injured horses. Recently, 2-deoxy-d-glucose was determined to be a potent stimulant for the tenogenesis of human stem cells in culture. In this study, we are examining the effect of 2-deoxy-d-glucose on tenogenic properties of stem/progenitor cells derived from the tendon proper and peritenon of the equine super digital flexor tendon. We hypothesize that 2-deoxy-d-glucose will lead to an inhibition of glycolysis which will bolster tendon formation in the progenitor cells. In order to test this, we have provided cells with 0, 10, 100, and 1000 μM of 2-deoxy-d-glucose over a 48-hour period in monolayer culture. We are using real-time quantitative polymerase chain reaction to assay gene expression in response to the glycolysis inhibitor. Concentrations of the glycolysis inhibitor that optimally promote tenogenesis will be further investigated in a three-dimensional tendon construct model before consideration of its application as an equine tendon repair therapeutic.

| Eva Goodisson |

Major: Managerial Economics
Minor: Technology Management
Mentor: Dr. Douglas Findlay
Research Type: UHP Thesis

Post Covid19 Air New Zealand Marketing Plan

Covid19 has served as a strategic inflection point to change the landscape of the airline industry and who the dominant players are. Air New Zealand is a premium airline with an opportunity to become passengers first choice when flying. The change in economy, consumer behavior, airline operations and market share pre and post covid have been analyzed to determine how Air New Zealand can uniquely position themselves as a premium airline that will sustain a competitive advantage over other airlines. I have researched the 'secret sauce' for what makes premium airlines successful today, and what differentiation possibilities covid19 has given us that Air New Zealand can leverage moving forward. We now exist in a state of post pandemic opportunity – a position that is exciting and uncertain. There is hesitation to travel yet eagerness, and the implications of my marketing plan will reflect the change in airline operations, market share and traveller priorities post covid19, through leveraging the benchmark of responsibility and leadership in New Zealand and the excitement of travel.

| Rachel Hirota |

Major: Animal Science
Mentor: Dr. John Eadie
Research Type: Honors Thesis in Major

Behavioral plasticity in personality and dominance in relation to stress response in female Wood Ducks (*Aix sponsa*)

Animals display personalities through consistent individual variation in behavior in response to their environment. The complex behaviors and social interactions of birds provide an excellent opportunity to relate avian personality to ecology and evolution. Behavioral traits—such as boldness, exploration, and aggressiveness—and plasticity of these traits can greatly impact physiological trade-offs and population dynamics. The Wood Duck (*Aix sponsa*) is a model species for female sociality and behavioral studies as females are philopatric, exhibit conspecific brood parasitism, and are cavity-nesting—allowing for ample opportunity for female-female interactions. While personality has been explored in many facets, its role in understanding individual stress response has received less attention, even more so in relation to female social hierarchies. This study aims to a) determine long-term plasticity of personality through behavioral assessments and b) contribute to a project relating personality to stress physiology. Behavioral plasticity will be assessed longitudinally by performing standardized behavioral assays of In-Hand Docility Tests (IHDT) and Open Field Tests (OFT) and dominance ranks will be evaluated using food access experiments. These data will then be compared to data from the same birds collected during previous (younger) life stages.

| Alina Kajley |

Major: Global Disease Biology
Minor: Communication
Mentor: Dr. David Rizzo

Comparing COVID-19 Testing Factors and Data Across University Campuses in the United States

Once it became apparent that COVID-19 was sticking around and continuing to spread, universities were forced to consider how to move forward while keeping campuses safe. Although most universities transitioned to online classes, a portion of students, faculty, and staff were still on campus for numerous reasons. Social distancing, wearing masks, and handwashing were the obvious tactics for reducing transmission, but they were not enough to prevent outbreaks—especially when asymptomatic carriers were involved. Many universities developed COVID-19 surveillance testing programs to proactively halt outbreaks and effectively monitor campus health. University surveillance testing programs encourage individuals without symptoms to get tested, minimizing spread through asymptomatic carriers. Additionally, the results of these testing programs and other relevant campus data have been made available to the public through online COVID-19 dashboards. This study aims to collect and compare COVID-19 surveillance testing program designs and testing data across 25 university campuses in the United States. Comparisons from this study will allow us to recognize the diversity among university testing programs and identify trends between contextual testing factors and COVID-19 campus dashboard data. Testing factors include test type, test method, testing accessibility, university testing requirements, testing incentives, and communication of test results. Dashboard data includes, but is not limited to, weekly testing positivity rates and number of tests performed per week.

| Kendal Kooreny |

Major: Viticulture and Enology

Minor: Professional Writing

Mentor: Dr. Alison Bright

Research Type: UHP Thesis

COVID-19 and the Wine Industry: How the Pandemic Changed the Daily Lives of Industry Workers and Influenced Wine Sales

The international wine industry has been greatly altered since COVID-19 was declared a pandemic in March of 2020. Since the pandemic began, the wine industry has faced significant challenges. These challenges include the following: changes in wine sales (in terms of earnings, sales methods, and products sold), disruptions to the daily routines of wine industry workers, and adjustments in companies' marketing strategies. The industry has had to accommodate the changes caused as a result of the pandemic while remaining relevant to consumers; however, while sales and employment figures have provided quantitative data, there has yet to be any qualitative data that demonstrates the effects of the pandemic on this industry. In this whitepaper directed to the wine industry, I present the stories behind all of these changes, illuminating exactly how COVID-19 has impacted the wine industry and how these adjustments are projected to influence the industry in the long term.

| Mengmeng Luo |

Major: Sustainable Agriculture and Food Systems

Minor: Sustainability in the Built Environment and Studio Art

Mentor: Dr. Kate Scow

Research Type: UHP Thesis

Impacts of Long-term Dairy Manure Amendments on Soil Carbon and Microbial Community Dynamics

The application of animal manure as a soil amendment has the potential to build up soil organic carbon (C), forms good soil structures to support plant growth, and provides slow-release nutrients for crops and energy/C sources for soil microbial communities. In a field study of a corn-wheat forage rotation over five growing seasons, we compared three manure treatments with same total nitrogen (N) input: 1) 100% mineral fertilizer, 2) 50% mineral fertilizer, and 50% dairy manure, and 3) 100% dairy manure. One-meter soil cores were collected at the end of the field trial. Soil physicochemical properties, soil water-stable aggregates, microbial-available C, C distribution in soil structure, and microbial community composition were contrasted at different soil depths (0-15, 15-30, 30-60, and 60-100 cm). Our results indicated that both levels of manure amendments significantly increased total and reactive soil C storage in topsoil while not deeper layers. Manure amendments boosted soil microbial biomass in all layers, and its impact diminished as soil depth increases. High-level manure amendment resulted in a significant amount of manure-C in water-stable aggregates. The findings of this study would be helpful to inspire the development of sustainable agricultural practices that support crop productivity, soil health, and ecological resilience.

| Anna Maddison |

Major: Environmental Toxicology

Mentor: Dr. Michele La Merrill

Research Type: Honors Thesis in Major

Investigation Of Substrate Processing In the Liver To Help Explain The Association Between Fatty Liver And Pesticide Exposure

Nonalcoholic fatty liver disease (NAFLD) affects a quarter of the world population and is associated with heart dysfunction, hepatic insulin resistance and increased occurrence of hepatocellular carcinoma. Insulin resistance is especially prevalent in South Asians, but findings suggest this is not attributable to genetics or diet alone. Rather, increased incidence of type 2 diabetes in South Asians is associated with higher levels DDT exposure. A possible mechanism for this finding is insulin resistance due to increased hepatic lipids, which is supported by animal studies showing DDT causes increased hepatic cholesterol, lipids, and lipogenic enzymes[MALM1]. In this study, we aim to investigate the relationship between DDT and NAFLD by investigating gene expression patterns in the livers of perinatally exposed female mice which could indicate altered hepatic lipid metabolism. We expect changes in RNA consistent with NAFLD, specifically, upregulated expression of Lpl, Glut2, Cyp7a1, ChREBP, ACC1, and Srebf1 and downregulated expression of PPAR α and CPT1a. By understanding the mechanism of the underlying relationship between DDT and excess hepatic fat we can make better decisions regarding future pesticide use and treatment of NAFLD.

| Angelica Martinez |

Major: Animal Science

Mentor: Dr. Kristina Horback

Research Type: UHP Thesis

The Effect of Rearing Environment Complexity and Depth on Laying Hen Jumping Behavior Over Time

Recent legislation in California requires cage-free housing for egg-laying hens and it does not specify what the rearing environment should include, which has important implications for animal welfare. Rearing environment complexity, through perches and varying tiered structures, has the potential to affect future spatial and physical ability. Similarly, depth, or vertical distance from the ground, could affect jumping behavior in laying hens. Therefore, this study will measure the effects of rearing environment complexity and depth on laying hen jumping ability over time. The study design involved three different rearing environments: floor reared, single-tier, and multi-tier. Laying hens were assessed using a modified visual cliff, an added perch and platform, with three depths (15, 30, 90 cm) being tested at three ages (8, 16, and 30 weeks). A random sample of 270 trials where hens crossed the visual cliff were selected for behavior coding using Observer software. The following behaviors were recorded to measure jumping ability: latency to achieve balance, wing flaps, foot adjustments, and tail position. I hypothesize that laying hens will have better jumping ability with shallower cliff depth and when reared in more complex environments.

| Zoe Mitchell |

Major: Food Science
Mentor: Dr. Maria Marco
Research Type: UHP Thesis

Chemical and microbial characteristics of olive fermentations performed at home

Little is known about the chemical properties and microbial contents of food fermentations performed at home. For this study, we investigated the home fermentation process for Sicilian-style olives. In total, nine 1-gallon fermentations were initiated by six participants using the same recipe and same source of Sevillano olives, water, salt and white distilled vinegar. Three of the participants prepared replicate fermentations. The olives and brine were initially sampled every day for the first week and then biweekly for the remaining four months. At the time of submersion, the pH was 2.6 ± 0.1 and salinity was 62.8 ± 7.0 ppm. The pH increased and salinity decreased over time such that the brine was replaced after 9 weeks to maintain food safety. Replicate buckets showed similar, but not identical trends. During brine change, two replicate buckets had a pH difference of 0.2 and salinity difference of 5 ppm. Visual analysis of brine surfaces also indicated highly variable development of yeast pellicles between all nine buckets. The findings from this study showed the variability of home fermentations, even when performed using the same initial ingredients and conducted in parallel by the same individual.

| Rebecca Moore |

Major: Animal Science
Minor: Social and Ethnic Relations
Mentor: Dr. Maja Makagon
Research Type: UHP Thesis

Hens in Backpacks: Does the Weight of the Sensor Impact Their Behavior?

An increasing number of researchers rely on animal mounted sensors for automated data collection, but do these sensors change the animal's behavior thus influencing the data? Using the laying hen as a model, we sought to determine whether the weight of the sensors (ranging from 3.3% to 7.2% of their bodyweight) impacts their movement within a multitiered aviary structure. We hypothesized that hens with heavier sensors would have more difficulty transitioning between vertical tiers but would habituate to sensor weight over time. Hens (n=59) were housed across six pens. Of these, 50 were individual marked and assigned to one of five treatment groups (four sensor weights and a control). The hens were observed 1 and 12 days after receiving sensors for 3 hours/day. We recorded the number and success of transitions between vertical tiers for each hen. Preliminary results (based on data from two pens) suggest that the presence of a backpack weight impacted the number of transitions attempted, regardless of sensor weight category. The success of transitions was only affected on the first day of observation, indicating the hens habituated to the presence of the sensor.

| Landin Noland |

Major: Ecological Management & Restoration
Mentor: Dr. Valerie Eviner
Research Type: UHP Thesis

Resilience of Chaparral Systems: Effects of a Short Fire Return Interval on Chaparral Regeneration in the Pepperwood Preserve

California's chaparral has evolved with fire, yet little is known about how increased fire frequency will change post-fire recovery, and thus the persistence of this ecosystem under a changing fire regime. Chaparral species have two major mechanisms of post-fire regeneration, germination from surviving seedbank or sprouting from surviving root systems. Significant concern exists that short fire return intervals can compromise both mechanisms, killing emerging seedlings before they mature. This could lead to conversion of chaparral to grassland. I will assess the impact of frequent burns on chaparral recovery at Pepperwood preserve, which nearly completely burned in the 2017 Tubbs fire and a portion of which re-burned in the 2019 Kincadee fire. I will monitor chaparral areas burned once versus twice and compare: (1) regeneration of shrub seedlings derived from resprouting versus germination, (2) grass cover and biomass, and its fuel potential to carry a future fire; and (3) the prevalence of ephemeral fire-following species. These results will fill knowledge gaps in chaparral ecosystem function which will be critical for predicting its persistence under a changing climate and provide insight to land stewards seeking to maintain diverse ecosystem services, utilize cultural or prescribed burning, mitigate wildfire damage, or amplify post-fire recovery.

| Megan Phelps |

Major: Environmental Science & Management
Mentor: Dr. Gwen Arnold
Research Type: Honors Thesis in Major

One Climate Crisis, Many Climate Solutions: Differences between Prognostic Frames Employed by Climate Organizations in San Diego

Climate activism and advocacy has escalated in recent years, with figures like Greta Thunberg at the forefront of what people might think of as a single, unified global climate movement. However, this movement is far from homogenous. Though climate organizations are motivated by the same broad topic of climate change, how do their narratives surrounding (i.e., framing of) climate solutions differ? How does framing correlate with socio-demographic and political affiliation of members within climate organizations? This article attempts to answer these questions, using three San Diego climate organizations as case studies. The study employs surveys to determine socio-demographic and political characteristics. It uses interviews; online content, including websites, mailings, press releases, and social media; and observations from meetings to analyze key themes in each organization's climate solution framing. Results will illustrate whether organizations fill different "niches" by using distinct frames to appeal to different participants. Findings will also point to possibilities for coalition building within the climate movement as a whole: by acknowledging divergence in the way social movement organizations define climate change, these groups can unify around shared goals to demand the rapid, far-reaching change required to address the global climate threat and preserve the livability of the planet.

| Raquel Ponce |

Major: Animal Science
Mentor: Dr. Damien Caillaud
Research Type: UHP Thesis

Behavioral Differences Between Urban-Adapting and Non-Urban Primate Species

Humans have increasingly disturbed natural habitats through urbanization, which has resulted in the loss of wildlife biodiversity. Some primate species have been able to adapt to human disturbance in urban areas, while other species only occur in non-urban areas. Primate species that are able to adapt to urban areas may be predisposed to this ability due to the behavioral traits that are expressed in their natural environment. The objective of this study is to identify the factors that allow some primate species to live in urban areas. We collected data from 3000 primary literature articles which were compiled in the Primate Social Behavior and Conservation database from the Caillaud lab. We collected data for 68 urban-adapting primate species and 192 non-urban primate species. We analyzed our data using phylogenetically controlled generalized least squares regression in R. We compared the average percent time feeding and foraging and the variability in percent time engaging in social behavior between urban-adapting and non-urban species. Preliminary analyses suggest that urban-adapting species in their natural environments tend to spend a higher percentage of their activity budget feeding and foraging and have a more variable engagement in social behavior compared to non-urban species. Therefore, primate species that show these behavioral traits in their natural habitats are more likely to be able to adapt to urban areas. These results should be taken into consideration during conservation efforts to prevent the artificial selection for urban-adapting species and the eradication of non-urban species.

| Owen Sowerwine |

Major: Environmental Science & Management
Mentor: Dr. Kate Scow
Research Type: UHP Thesis

Methods Comparison for the Quantification of Inorganic Carbon in California Agricultural Soils

Globally, soils hold around 2500 Gt of carbon, making them one of the largest carbon sinks, of which 950Gt is inorganic carbon. Enhanced silicate weathering in agricultural lands offers a new approach for increasing inorganic carbon in soils, necessitating robust quantification of carbon sequestration associated with enhanced weathering reactions. Various methods of quantification have been developed to measure soil inorganic carbon (SIC), but little consensus exists in the literature on best approaches for local soil conditions. In order to provide guidance for a best method in California's agricultural soils, SIC quantification techniques were compared via literature review. The parameters for determining suitability of each technique were cost, time per sample, environmental impact, accuracy, precision, and scalability. In addition, input from analytical labs across the United States was gathered to identify commonly used SIC methods. Pressure calcimetry, loss on ignition, thermogravimetric analysis, and elemental analysis were found to be suitable for use in California agricultural soils. These results provide guidance to policy makers and land managers as they seek to quantify SIC associated with enhanced weathering in California's working lands.

| Daniella Schoenfeld |

Major: Sustainable Agriculture & Food Systems
Mentor: Dr. Kimberly A Rodrigues
Research Type: Honors Thesis in Major
Ugly Fruit Club

The past 20 weeks have consisted of working with The Cloverleaf Farm to help them solve their problem of food waste and the associated lost revenue. Cloverleaf Farm is a 8-acre organic orchard farm, located on the border of Dixon/Davis, working to be socially, economically and environmentally sustainable while achieving their goal of reducing food waste on the farm. Unfortunately, due to problematic pests and heat stress during mid day, much of their stone fruit is damaged and deemed as "seconds" in the industry. "Seconds" (referred to as "ugly") cannot be sold at premium prices, however they are still perfectly edible and thus marketable. Unfortunately, not many people wish to purchase these slightly blemished fruits. By utilizing Cloverleaf's existing "Ugly Fruit Club" (UFC) we plan to help increase membership and awareness of the UFC over time using tools and platforms designed specifically to help The Cloverleaf Farm team. The COVID-19 pandemic caused a reduction in the number of tools we can provide, yet the goal remains the same: reduce food waste and increase club membership.

| River Taylor |

Major: Environmental Science & Management
Mentor: Dr. Brad Hanson
Research Type: Honors Thesis in Major
Management of Invasive Paterson's Curse (Echium plantagineum) Using Herbicides

Paterson's curse, *Echium plantagineum*, is a flowering plant native to Mediterranean Europe and northern Africa. It has been reported to be a significant invasive weed in large portions of Africa, Argentina, Australia, Canada, Chile, New Zealand, and Uruguay. In the United States, Paterson's curse, also known as vipers bugloss, has been reported in Massachusetts, New York, Pennsylvania, Oregon, and California. While not currently a major weed in California, its impact on agriculture and livestock in other non-native regions is reason enough to be concerned. The purpose of this study is to obtain data on herbicidal control options for Patterson's curse in California. Particularly, the study focuses on herbicides originally tested on the long established Australian invasive population as well as testing the effectiveness of herbicides more commonly used in the United States for controlling broadleaf weeds in grasslands. It is expected that all fourteen postemergence herbicides tested in a greenhouse environment will significantly reduce growth of Paterson's curse. Developing data on the performance of herbicides registered in the US could provide land managers with information about options for managing Paterson's curse before it becomes a more widespread problem.

| Quentin Thouvenot |

Major: Animal Science

Mentor: Dr. Kristina Horback

Research Type: UHP Thesis

Aggressive and Exploratory Behaviors in Growing Gilts during Farrowing and Nursery Phases

It is known that aggressive behaviors among growing piglets can lead to injuries among these animals, leading to significant financial ramifications for producers within the US pig industry. Video and audio recordings of a single litter housed at the UC Davis Swine Teaching and Research Facility (n = 5 gilts, and n=4 boars) were analyzed for the prevalence of aggressive and exploratory behaviors occurring within farrowing and nursery pens. The goal of this study was to determine if aggressive/exploratory behaviors performed by the gilts while in farrowing pens would continue to occur at a similar prevalence when these gilts were moved to nursery pens with their litter. Gilts were focused on specifically because they had been numbered individually for a previous study and were thus easier to identify. Behaviors recorded included: headbutting, biting, shoving/pushing, chasing, levering (aggressive), and sniffing (exploratory). Both prevalence and duration of the behaviors were recorded (162 mins in farrowing pen, 378 mins in nursery pen). Teat ranks during observations in farrowing pens were also recorded. Upon examination of recorded data, it was found that gilts 4 and 5 displayed the most aggressive and exploratory behaviors in both farrowing and nursery pens, while gilt 1 displayed little to none of these behaviors, and was often the recipient of fights that occurred. Teat rank interestingly mirrored this trend of dominance for gilts 4, 5, and 1, with gilts 4 and 5 occupying a more favorable teat position (nearest to the sow's head for better milk quality) , and gilt 1 occupying the least favorable teat position (bottom last teat pair). This study offers further insight into the aggressive/dominance dynamics within an isolated, growing litter of piglets, and may be used to further understand and explain aggressive behaviors within growing piglets and how these in turn affect financial dynamics within the US pig industry.

| Rasika Venkatesh |

Major: Biotechnology

Mentor: Dr. Luis Carvajal-Carmona

Research Type: Honors Thesis in Major

Admixture Analysis of Hispanic Populations in TCGA Database for Gastric Cancer Mutations

Gastric cancer (GC) is the third cause of cancer-related deaths worldwide and limited research has been done regarding its etiology and genetics in non-European populations. Understanding the genetic etiology of GC is important in alleviating health disparities among minority populations, particularly in Hispanic patients who are twice as likely to die from GC. Towards this end, this study aims to identify novel germline variants associated with GC and determine the prominence of certain mutations in various populations through global and local genetic ancestral analyses. Utilizing local ancestry analysis in examining the genetics of complex traits has the potential to increase our ability to detect genetic associations in understudied admixed genetic ancestral populations. We will use admixture analysis, which looks at regions or variants and ancestry within the GC patient population against a reference control population of individuals with non-gastrointestinal cancers, to identify novel variants associated with GC in EUR, AFR, and AMR genetic ancestral groups. This analysis will provide etiological information that furthers our understanding of GC in Hispanic populations, which may aid in the identification of individuals at high risk for GC and the development of additional treatments.

| Jennifer Leonita Wijaya |

Major: Food Science

Mentor: Dr. Juliana De Moura Bell

Research Type: UHP Thesis

Effects of Extraction Parameters on Extractability and Functional Properties of Lentil Proteins

The need for alternative protein sources, especially plant proteins, has increased in popularity in the food industry in recent years due to its high nutritional value and its role in supporting sustainability. Legumes, particularly lentils, are widely known as prominent sources of proteins. Lentil proteins are a source of essential amino acids and possess a wide range of functional properties that open up their potential use in several food product applications. Various extraction conditions have been used to extract lentil proteins. However, the effects of key extraction parameters on the extractability and structural modifications of lentil proteins, the latter having a key impact on the technological and functional properties of the extracted protein, remain unclear. This review highlights the effects of different extraction methods on the extractability of lentil proteins and focuses on how the extraction parameters could as well affect the functional and the biological properties of lentil proteins.

| Miranda Willard |

Major: Managerial Economics

Minor: Environmental Policy Analysis & Planning

Mentor: Dr. Stephen Boucher

Research Type: Honors Thesis in Major

Effectiveness of Drought Tolerant Maize in Mozambique and Tanzania

Maize is a vital crop for both income and food security in Sub-Saharan African countries, such as Mozambique and Tanzania. Drought tolerant (DT) maize varieties have been developed and proclaimed to be an important technology that will offer protection for small farmers. On-Farm trials by The International Maize and Wheat Improvement Center have shown a 10% yield advantage for DT maize varieties over comparison maize varieties, with that advantage growing to 12% under drought conditions. However, it is still unknown whether a yield advantage when using DT maize exists for small farmers in practice, and under what types of weather conditions that advantage exists. I analyze data from small farmers in Mozambique and Tanzania to determine whether a yield advantage can be found when treatment groups in these countries are offered DT maize. Using both a difference-in-difference and ANCOVA regression technique, I estimate the impacts of DT maize on yields in different combinations of weather conditions concerning mid-season and early-season drought. I find under both difference-in-difference and ANCOVA regression techniques, there is a substantial yield advantage for treatment groups offered DT maize over control groups during mid-season drought; however, when preceded by an early-season drought, the yield advantage of DT maize under mid-season drought is heavily offset.

| Katherine Woodworth |

Major: Environmental Science & Management

Minor: Soil Science

Mentor: Dr. Sarah Yarnell

Research Type: Honors Thesis in Major

Effects of Ditching on Soil Structure and Vegetation Community in Alpine Fens

Fens are perennially wet, groundwater-dominated ecosystems that provide refugia for native species during the summer dry season in California. This study focused on the impacts of manmade drainage ditches on soil structure and wetland-dependent vegetation in alpine fens. Surveys were conducted in fall of 2020 in the Childs Meadow complex, which is an ongoing meadow restoration site in the Lassen National Forest in California. Sample plots were located above (upslope) and below drainage ditches in two fen locations within the complex. Soil cores were collected in each plot and analyzed for mineral and organic content, texture, color, and depth to groundwater. Percent cover of representative wetland-dependent species, such as Sphagnum spp. moss, was estimated in each 40 by 40 cm plot. Above-ditch plots had considerably wetter soils with higher organic matter content, as well as greater percent cover of Sphagnum moss. In both fen locations, areas below the ditches had reduced organic soil components, increased grass cover, and greater depth to groundwater. This study provides a baseline of soil and vegetation conditions in two impacted fens in Childs Meadow. Continued annual monitoring of the study plots will provide valuable data on the impacts of restoration actions planned for 2022.

| Elva Xian |

Major: Global Disease Biology

Mentor: Dr. Tiffany Lowe-Power

Research Type: Honors Thesis in Major

Validating an Assay to Test the Function of Putative Type VI Effectors in E. coli

The Type VI Secretion System (T6SS) is an important structure that mediates interbacterial competition in gram-negative bacteria. The molecular syringe-like apparatus uses a contracting mechanism that allows the bacteria to shoot toxic proteins called effectors across its cellular envelope into other bacteria. For each effector, there is a corresponding immunity protein that protects the bacteria from the effector. This allows the bacteria to kill foreign bacteria without hurting themselves. Previous random barcoded transposon site sequencing (RB-TnSeq) data showed that immunity genes were vital for the growth of plant pathogenic *Ralstonia* in planta. We explored the function of effectors without their respective immunity proteins in *E. coli* using pBAD18 plasmids with an arabinose inducer. We saw a reduction in *E. coli* colonies when the effector gene was expressed. This is consistent with previous research showing the toxic effect of effectors when immunity proteins are not present. A greater understanding of the T6SS will allow researchers to manipulate it for in planta use.

College of Biological Sciences



| Allison Andre |

Major: Neurobiology, Physiology & Behavior

Minor: Psychology

Mentor: Dr. Dave Furlow

Research Type: Honors Thesis in Major

A comparative study of thyroid hormone associated regulated gene expression in the *Xenopus laevis* brain

During brain development, thyroid hormone (TH) plays a vital role in regulating gene transcription via its two forms, T4 and T3, guiding processes that shape the brain for optimal function throughout the lifetime. Past research in rodent models sought to identify the TH signaling pathway components and regulated genes in the developing brain, but many of the specifics, particularly direct transcriptional targets of T3, remain unknown. The aim of this study was to use transcriptomic data from T3-treated *Xenopus laevis* tadpole brains to characterize the gene expression profile in this amphibian model of TH action, in comparison to other vertebrates. As hypothesized, we found that many known regulators of TH, such as thyroid hormone receptors α and β , deiodinases 2 and 3, retinoid x receptors α , β , and γ , *slc16a2*, *ncoa1*, *ncor1*, and *ncor2*, were present in the *Xenopus* brain transcriptome. Additionally, we identified a handful of genes previously recognized as direct targets of TH in mammalian systems, most notably *klf9*. These results provide further evidence that TH signaling in the brain is conserved across species, and suggest the presence of a core group of genes that are consistently targeted by T3 amidst its otherwise broad array of transcriptional targets.

| Vincent Basas |

Major: Neurobiology, Physiology & Behavior

and Psychology

Mentor: Dr. Dave Furlow

Research Type: Honors Thesis in Major

Establishing the RXR ligand regulated gene network in the developing *Xenopus laevis* brain.

The retinoid X receptor (RXR) is a nuclear receptor (NR) involved in important functions such as metabolism, reproduction, and development by dimerizing to other NRs, including thyroid hormone receptors (TRs) and liver X receptors (LXRs), among others. Highly expressed in the brain, RXR is also thought to play a role in central nervous system development and function; however, little is known about RXR regulation of specific gene networks in the brain. To discover RXR regulated genes, we treated *Xenopus laevis* (African clawed frog) tadpole brains with various ligands: thyroid hormone (T3), two RXR agonists, and an RXR antagonist alone and in combination with T3, which is known to remodel the brain at metamorphosis. At two time points, we determined gene expression differences by focusing on genes more highly expressed upon RXR agonist treatment or inhibited by RXR antagonists. Detailed transcriptomic data analysis is currently underway, and thus far we have identified apolipoprotein E (a known RXR-LXR heterodimer regulated gene in other organs), and the glia-specific fatty acid binding protein 7 gene as regulated genes of particular interest. Our analysis will establish RXR dependent gene expression pathways in the brain and indicate the relevant RXR-NR partnerships to study further.

| Audrey Bantug |

Major: Biochemistry & Molecular Biology

Mentor: Dr. Carlito Lebrilla

Research Type: UHP Thesis

A Quantitative Analysis of Oligosaccharides with Liquid Chromatography/Mass Spectrometry

Polysaccharides are essential to living things, especially in the diet and metabolism of humans. It is therefore important to develop good analytical methods to study and understand them. This experiment looks into one procedure using Fenton's initiation toward defined oligosaccharide groups (FITDOG) to break down polysaccharides. Broccoli and soy flour samples were spiked with either one or a pool of seven known oligosaccharide standards, then reduced with sodium borohydride. Next, the samples went through a high-performance liquid chromatography and quadrupole time-of-flight (HPLC-QTOF) mass spectrometer to identify and quantify the compounds found within them. Here, I validated the quantification of the oligosaccharide spikes by comparing their actual concentrations with those calculated from HPLC-QTOF peak areas. Results yielded a wide range of percent recoveries for each compound. In samples spiked with lower concentrations of maltohexaose or arabinohexaose only, percent recovery values for these two oligosaccharides exceeded 80%. In contrast, samples spiked with a pool of all 7 standards resulted in much lower percent recoveries for those compounds, ranging from 30% to 70%. This indicates that the procedure must be further optimized to obtain a higher percent recovery in complex matrices of oligosaccharides.

| Ryan Buchner |

Major: Genetics & Genomics and Statistics

Minor: Computer Science

Mentor: Dr. Gerald Quon

Research Type: UHP Thesis

Quantifying Changes in Gene Regulation Across Cell Types

As organisms develop, cells differentiate and specialize, allowing for the existence of complex tissues. While the DNA sequence of each cell does not typically change over the course of development, the regulatory network governing how genes are expressed changes over time. These changes in gene expression are responsible for the uniqueness of the different cell types in an organism. Understanding how the underlying gene regulatory network changes with development in both healthy and disease afflicted individuals is a central goal of molecular biology. However, there does not currently exist any useful statistical measurement for quantifying how far apart two populations of cells are with respect to transcriptional regulation. My work involves the development of machine learning-based models of gene regulation that facilitate estimation of transcriptional divergence of multiple cell types simultaneously. On simulated single cell transcriptional data, my model has shown the ability to accurately determine the separation between cell populations.

| Charlene Chan |

Major: Biological Sciences
Minor: Education and Japanese
Mentor: Dr. Neil Hunter
Research Type: UHP Thesis

Ex Vivo Ovary Culture to Characterize Key Meiotic Prophase Events in Mice

Sexual reproduction relies on meiosis, a cell division defined by one round of replication and two rounds of chromosome segregation that produce haploid gametes. In this study, we aim to establish an ex vivo ovary organ culture as an experimental model system to study key meiotic prophase events during oogenesis. To do so, we harvested fetal ovaries at E12.5, a stage when mitotically dividing germ cells will soon enter meiotic prophase I and cultured them for several days. To monitor meiotic progression, we took cultured ovaries and prepared chromosome spreads, then used immunofluorescence to visualize marker proteins associated with different substages of prophase I. After we determine that our ex vivo organ culture is a viable model to study meiosis, we plan to test whether the protein kinase Cdc7 has a conserved role in mammalian meiosis to trigger the initiation of recombination via DNA double-strand break (DSB) formation. To do this, we will inhibit its activity with a known Cdc7 inhibitor PHA-767491. If Cdc7 activity is necessary for DSB formation, we would expect to see diminished numbers of chromosome-associated foci of RAD51 and RPA, two proteins that bind the ends of DSBs.

| Lauren Ford |

Major: Neurobiology, Physiology, & Behavior
Minor: Gender, Sexuality, and Women's Studies
Mentor: Dr. Ken Kaplan
Research Type: Honors Thesis in Major

Replication-Stress Induced Nucleophagy Suppresses Chromosome Damage During Mitosis

Cell division is a highly regulated process that results in two daughter cells receiving identical copies of their parent genome. Replication stress that delays genome duplication can slow sister chromatid resolution, giving rise to ultrafine bridges (UFBs) in anaphase. UFBs are linkages that join sister chromatids and prevent segregation, leading to pathological chromosome nondisjunction and the formation of micronuclei (MN). It is proposed that autophagy suppresses this formation of MN by targeting partially formed nuclei through nucleophagy. Our previous studies indicate that this pathway is regulated by the Intra-S-Phase kinase cascade and is triggered by unreplicated DNA. Additionally, we found that the drug hydroxyurea activates replication-stress induced nucleophagy (ReSIN) to ensure the proper resolution of sister chromatids. Thus, we hypothesize that the ReSIN pathway contributes to the maintenance of chromosome stability. To test this hypothesis, we will engineer cells with mutations in their nucleophagy pathway and analyze their response to replication stress through the incidence of Rad52-GFP repair foci. We predict that nucleophagy mutants will lead to an increase in the frequency of cells with unresolved UFBs and DNA damage, as detected by Rad52-GFP, supporting the idea that nucleophagy contributes to maintaining chromosome stability, especially after replication stress.

| Yasameen Farahvash |

Major: Neurobiology, Physiology & Behavior
Mentor: Dr. Hilary Seligman/Dr. Dave Furlow
Research Type: UHP Thesis

Structural Racism in Scientific Literature

The ways in which we describe scientific data and results in research articles often lack racial inclusivity and sensitivity. For example, using the White race as the reference group in multivariable analyses normalizes the White experience as the standard experience, thereby implicitly acknowledging the existence of racial hierarchies. In this project, we investigated how structural racism pervades the scientific literature by examining the use of the White race as the reference group in observational public health studies in the United States. Our initial search identified 1,849 articles, of which we reviewed the top 300 based on relevancy. After screening for specific inclusion criteria, 88 articles were retained for full data extraction. Of these, 83 used "White" as the reference group; however, not all had "White" as the largest demographic group, a common rationale for determining the reference group. The scientific literature includes widespread use of the White race as the standard to which all other race and ethnicity outcomes are compared. Future efforts must support the elimination of the White-centric frame of thinking that negatively influences scientific research and undermines important outcomes at the intersection of race and public health.

| Tanya Freshour |

Major: Biochemistry & Molecular Biology
Minor: Human Physiology
Mentor: Dr. David Wittman
Research Type: UHP Thesis

Derivation and Analysis of Time Dilation and Gravitational Redshifts of Star S0-2

Near the Galactic Central Supermassive Black Hole

Einstein's theory of relativity predicts that a star passing close to a supermassive black hole will exhibit shifts in wavelength of emitted electromagnetic radiation (redshift). Special relativity predicts redshift due to time dilation while general relativity predicts redshift due to gravitation. The Newtonian model accounts for neither. The brevity of S0-2's close proximity to Sagittarius-A*, the supermassive black hole central to the Milky Way galaxy, allows isolation of those effects to one part of the orbit. The strong gravitational field near Sagittarius A* and velocity of S0-2 provide a unique opportunity to test the validity and precision of Newtonian and relativistic models compared to observational data. We use Taylor expansions to highlight the contributions of gravitational redshift and time dilation. Newtonian model error is calculated using derived equations and the Schwarzschild metric. A Newtonian model fits S0-2's orbit well, except near the black hole, where we find excess redshifts equaling the predicted relativistic effects. This confirms the existence of time dilation and gravitational redshift near supermassive compact objects.

| Star Ghanaat |

Major: Biological Sciences
Mentor: Dr. Mona Monfared
Research Type: UHP Thesis

A Patient-Facing Intervention for Weight-Neutral Care: Diet Culture in the Doctor's Office

The purpose of this patient-facing guidebook is to increase patient familiarity with the biological and social frameworks associated with obesity spread awareness about the importance of challenging diet culture, and inform patients of weight-neutral approaches to obesity, especially within the Sacramento area. While current clinical practice centers weight loss in treating obesity, weight-neutral approaches have a smaller body of scholarship. This guidebook will explain how prioritizing biomarkers, mental health, and nutrition can lead to equal or better outcomes for patients with obesity. This guidebook uses scientific review articles and individual studies from the past five years in the United States and in Europe to discuss topics like weight bias, causes and effects of obesity, and effectiveness of weight-neutral compared to weight loss-centered approaches. Additional research needs to be conducted to confirm specific findings, such as self-compassion-based approaches improving nutrition behaviors and body image, and to expand on more biochemical and genetic mechanisms behind obesity. This guidebook should be distributed to mental health clinics, medical centers, and dietitian offices to increase patient awareness about obesity and weight-neutral approaches, and distributing this guidebook to medical centers and nutrition departments within medical schools will also increase provider awareness of weight-neutral approaches to obesity.

| Sabah Khan |

Major: Biological Sciences
Minor: Technology Management
Mentor: Dr. Dave Furlow

Research Type: Honors Thesis in Major

One Student's Path in Entrepreneurship: BioBandage

In my UHP Signature Work, I will be walking through my journey with Biodesign leading me to creating a product and taking an entrepreneurship path with a startup company while in undergraduate studies. Through this one student perspective, I discuss my path coming into UC Davis, how I joined the Biodesign Challenge, meeting my team, creating our company, Biobandage, and the many steps we took along the way. During this path, I learned how to take different disciplines, such as science and business, to merge them together into this project. There were challenges and obstacles through this process and many learning opportunities that I hope will be able to help other students who may be considering an entrepreneurship path.

| Madeline Handy |

Major: Microbiology
Minor: Political Science
Mentor: Dr. Rachel Vannette

Research Type: Honors Thesis in Major

A Comparison Between the Gut Microbiome Composition of the Carpenter Bee Species *Xylocopa sonorina* and *Xylocopa tabaniformis*

The gut microbiota of bees has been shown to play a role in nutrition, immunity, and host fitness, making microbiome studies increasingly significant to our understanding of these important pollinators. Differences in the microbiome composition between social and solitary bees have pointed to social transmission as a key aspect in the maintenance of a functional microbiome. The goal of this study was to explore what roles host species, sociality, and environment play in gut microbiome composition by comparing the microbiomes of two carpenter bee species: *Xylocopa sonorina* and *Xylocopa tabaniformis*. Carpenter bees are considered solitary; however, *X. sonorina* has been seen to exhibit semi-social behavior which provides an opportunity to see how semi-social behavior influences the microbiome. Samples for both species were collected from Davis, CA along with samples of *X. sonorina* collected in Tempe, Arizona and *X. tabaniformis* collected at Anza-Borrego Desert State Park in California. Preliminary results for samples from Davis, CA suggest that *X. sonorina* and *X. tabaniformis* differ in the bacterial composition in the gut, though both are heavily dominated by the genus *Lactobacillus*. Further analysis will examine how host species and geographic location interact to form the gut microbiome in these two bees.

| Bryant Law |

Major: Neurobiology, Physiology & Behavior
Mentor: Dr. Mitchell Singer

Research Type: UHP Thesis

Characterization of Defensin Protein Usage by Myxococcales During Development and Hunting

Myxococcales are unusual amongst prokaryotes for their expression of defensin proteins, which was previously only known to be expressed in Eukaryotes as an antimicrobial. With an incomplete understanding of the role Defensins play in humans, our lab studies the use of defensin in Myxococcales' development and hunting to extrapolate the usage of the protein for both Myxococcales and humans. Finding characteristic defensin cysteine pattern in several Myxococcales, our lab attempted to elicit the function and expression of defensins in *M. fulvus* B02, *M. macrosporus* HW-1, and *M. xanthus* DK1622 based on RNA seq. After filtering data and molecular modeling of hypothetical, orf, putative, uncharacterized, unnamed, defense and defensin characterized proteins from the NCBI non-redundant reference sequence database, we selected four defensin genes. Each gene was examined using knockout mutations via electroporation of the vector plasmid pBJ114 and cloning with *E. coli* DH5α. We also assessed the usage of defensin as a tool for hunting with *P. carotovorum* JL1134, *P. syringae* pathovar *alisalensis*, *S. marcescens* ATCC 39006, *S. suberifaciens* CAI, and *X. campestris* pathovar *vitians* BS339.

| Ryan Lin |

Major: Neurobiology, Physiology, & Behavior

Mentor: Dr. Keith Baar

Research Type: Thesis in Major

Saturated Fatty Acids Decrease Collagen Synthesis and Function of Engineered Human Anterior Cruciate Ligaments

The ketogenic diet is a popular diet trend emphasizing consuming low carbohydrate and high fat foods with many purported benefits: weight loss, reducing cancer risk, and decreasing heart disease, among others. Previously, we have observed that saturated fatty acids significantly decreased ligament mechanics and collagen content in in-vitro human engineered ligament constructs. This study examines the effect of a high fat – low carbohydrate environment on in-vitro engineered anterior cruciate ligament (ACL) constructs. Cultured human ACL cells were embedded into a fibrin gel, engineered into ligaments between calcium brushite anchors, and subsequently treated with either bovine serum albumin (BSA) control, palmitic acid (PA, 16:0), glucose free BSA, and glucose free PA for 7 days with refeeding every other day. Glucose free BSA treatment did not significantly alter the mechanical and material properties but significantly decreased collagen content compared to control. PA either with or without glucose significantly decreased ligament mechanics and collagen content compared to control. These results suggest that a high fat – low carbohydrate environment decreases ligament structure/function. In vivo research is needed to determine whether a ketogenic diet has a negative impact on tendons and ligaments.

| Palavi Lodhia |

Major: Neurobiology, Physiology & Behavior

Mentor: Dr. Pamela Lein

Research Type: UHP Thesis

Does a Ketogenic Diet Delay the Onset or Reduce the Severity of Alzheimer's Disease-Like Pathology in a Transgenic Rat Model?

Alzheimer's disease (AD) is the most prevalent age-related neurodegenerative disease in the United States, and neuroinflammation appears to play a role in its etiology and progression. We hypothesize that the ketogenic diet will be an effective strategy for delaying the time to onset and/or severity of AD because of its anti-inflammatory effects. However, patient compliance with long-term ketogenic diets is poor, but evolving evidence suggests that an intermittent ketogenic diet (a ketogenic meal for one of two meals per day) may be sufficient to cause an anti-inflammatory effect. We hypothesize that both intermittent and fully ketogenic diets will improve cognitive function, decrease neuroinflammation, and decrease histological markers of AD pathology. To test this hypothesis, control and TgF344-AD rats, a transgenic rat line that expresses two human risk genes for AD, will be randomly assigned to 6 months of age to constant ketogenic, intermittent ketogenic or isocaloric control diets. To evaluate the effects of different durations of the diets, the rats will undergo behavioral tests to assess cognitive function and then be euthanized for histological analysis at either 8 or 12 months of age. Thus far, we bred and aged the rats to six months, manufactured the diets, performed a preliminary diet study to determine the daily caloric intake required to maintain weight, and started the animals on the diets.

| Noah Marx |

Major: Cell Biology

Minor: Computational Biology

Mentor: Dr. Lisa Miller

Research Type: UHP Thesis

In Vitro 3-Dimensional Coculture with Fibroblasts Maintains the Phenotype of Primary Rhesus Macaque Type II Alveolar Epithelial Cells

Type II alveolar epithelial (AT2) cells are specialized cells that make up approximately 5% of the surface area of the alveoli. AT2 cells are responsible for the production of surfactant as well as several antimicrobial agents. They also function as progenitor cells for the repair process after lung injury. Despite their importance to pulmonary biology, AT2 cells remain relatively understudied because they are very difficult to culture in vitro. In a conventional two-dimensional culture system, primary AT2 cells lose their distinctive phenotype within 3-5 days, which makes this system unsuitable for most studies. To solve this problem, we utilize a three-dimensional coculture system employing primary rhesus macaque fibroblasts to maintain the phenotype of primary rhesus macaque AT2 cells. In this system, the primary AT2 cells are grown in a monolayer on top of a Matrigel matrix containing the primary fibroblasts. The contact between the fibroblasts and AT2 cells, in addition to growth factors present in the culture medium, maintains the sftpc⁺ phenotype of the AT2 cells for at least 7 days. This model will enable further investigation into the effects of various compounds including wildfire ash and e-cigarette liquids on the health and function of AT2 cells.

| Naomi Murray |

Major: Evolution, Ecology, & Biodiversity

Mentor: Dr. John Stachowicz

Research Type: Honors Thesis in Major

Variation in eelgrass wasting disease severity affects consumption patterns and preferred food availability for herbivores

Eelgrass wasting disease has been responsible for multiple die-offs of eelgrass (*Zostera marina*) over the last century. Despite major outbreaks, little is known about the ecology of the disease, particularly regarding interactions between the pathogen, seagrass, and epifaunal species. I measured the severity of wasting disease in Bodega Harbor and investigated whether disease alters plant susceptibility to herbivory. I found that disease severity varies seasonally; necrotic lesions caused by eelgrass wasting disease were virtually absent in early summer but peaked at nearly 20% leaf cover by midsummer. This large fluctuation in the amount of decaying plant tissue may change food availability for herbivores of eelgrass. To determine if herbivores showed a preference for lesioned or green plant tissue, I conducted feeding trials offering isopod *Pentidotea resicata* a choice between the two tissue types. Lesioned tissue was strongly preferred. I used structural equation modeling to further relate plant trait data to observed feeding preferences. As plant lesion cover increased, the phenolic acid content of lesion tissue decreased. Phenolic acids are a potential chemical defense against herbivores, and the loss of phenolics was associated with increasing herbivore consumption. This facilitation of herbivore feeding by disease may influence seasonal progression in disease severity.

| An Nguyen |

Major: Biochemistry & Molecular Biology

Mentor: Dr. Pamela Lein

Research Type: Honors Thesis in Major

Characterization of Neuropathology Associated with Tetramethylenedisulfotetramine (TETS)-induced Status Epilepticus in Mouse Model

The rodenticide tetramethylenedisulfotetramine (TETS) is a convulsive agent that is considered to be a chemical threat agent by the United States Department of Homeland Security due to its high toxicity and ease of synthesis. TETS cause seizures that can rapidly progress to status epilepticus (SE) by blocking the GABAA receptor channel. The GABAA receptor is normally activated by the primary inhibitory neurotransmitter in the brain. There is no established antidote for TETS exposure, and current countermeasures include administration of standard anticonvulsive agents to control seizures and increase survival. However, these treatments do not protect against the long term morbidity associated with TETS poisoning, which includes recurring seizures, cognitive deficits, and affective disorders. To determine and evaluate the appropriate antidote for TETS, a preclinical model that recapitulates the neuropathology reported in humans that survive TETS-induced seizures is needed. Thus, we are characterizing a mouse model of TETS-induced SE using the NIH Swiss mice. In this model, a single administration of TETS induces SE in >50% of exposed mice who exhibit a seizure duration of more than 40 min. The neuropathology associated with TETS-induced SE was characterized by immunohistochemical analyses of astrogliosis and microglia activation in specific brain regions at varying times post-exposure. Our preliminary data indicate that there is increase in astrogliosis and microglia activation in specific brain regions 3 days following TETS exposure. This work is supported by funding from the NIH (CounterACT grant U54NS079202).

| Jed Keenan Obra |

Major: Neurobiology, Physiology, & Behavior

Minor: Psychology and Public Health Sciences

Mentor: Dr. Keith Baar

Research Type: UHP Thesis

The Role of Collagen Composition and Lateral Force Transmission with Aging

Collagen is the most abundant protein in the body and functions to provide the mechanical strength of connective tissues. In muscle, collagen fibrils function both to hold muscle fibers together and transmit force laterally between fibers. With aging, force transmission and muscle mass is reduced; however, how changes to specific collagen isoforms or the matrix orientation contribute to force loss is currently unclear. The purpose of this study is to compare lateral force transmission in young and old people with changes in specific collagen proteins and the orientation of the matrix. To study this comparison, cross-sections of the gastrocnemius muscle were taken to determine specific collagen content, while longitudinal sections were stained with picosirius red to determine matrix orientation. Fibrillar collagen isotypes I and V tended to increase with age, while circumferential collagen isotype VI decreased with age. Picosirius red staining showed that the collagen matrix is oriented at a $22.3 \pm 3.1\%$ angle to the fibers in young and $30.2 \pm 8.7\%$ in old subjects. By establishing the role of specific collagen proteins during aging, we hope to better understand the relationship between the extracellular matrix and force transmission in muscle and how this relationship is modified by age.

| Juliana Novaes |

Major: Neurobiology, Physiology, & Behavior and Spanish

Mentor: Dr. Erin Hamilton

Research Type: UHP Thesis

Latina Health Experiences and Perceived Discrimination in Health Care Settings

The purpose of this study is to investigate Latina women's healthcare experiences and occurrences of perceived discrimination in healthcare, as well as the associated effects of this discrimination on healthcare utilization, perceived quality of care, and general perceptions of the U.S. medical system. This research is motivated to extend beyond current studies' emphasis on legal policies and quantitative data, as well as the focus on Latina health as it pertains to reproduction, instead highlighting direct testimonials of Latina individuals' experiences and overall impressions of U.S. healthcare. Qualitative data has been collected for this study through 10 in-depth, semi-structured interviews with Latina women in the Davis and Woodland area, conducted in English or Spanish through Zoom. Preliminary analysis of the interview data shows that most participants have experienced some form of discrimination or varied treatment in a healthcare setting. Many subjects expressed some level of dissatisfaction with one or more elements of the medical system in the U.S. The goal of this study is to highlight a variety of individual experiences of Latinas in healthcare that can be applied to future anti-discrimination or implicit bias trainings, as well as policy research and changes for healthcare institutions and professionals.

| Aditya Rao |

Major: Biochemistry & Molecular Biology

Mentor: Dr. Erin Hamilton

Research Type: UHP Thesis

Longitudinal Analysis of Healthcare Utilization Among DACA Beneficiaries

| Anysa Razaghzadeh |

Major: Neurobiology, Physiology, & Behavior
Minor: Psychology and Global & International Studies

Mentor: Dr. Peter Mundy

Research Type: Honors Thesis in Major

The Factors Associated with Social Cognition in Children with ASD

This study examined differences in children and adolescents with autism spectrum disorder without intellectual disability (ASD-WoID) and a typically developing (TD) comparison sample on measures of Theory of Mind (ToM) to test whether diagnostic groups differences could be explained in terms of variance on measures of working memory, inferential thinking, or verbal IQ (VIQ). There were 81 children in the ASD-WoID group and 44 children in the TD group between the ages of 8-15 years. The results show that the ASD-WoID group significantly differed from the TD group on the ToM, inferential thinking, and working memory measures, but there was no interaction of diagnostic group and VIQ group. Working memory and inferential thinking correlated with ToM in the ASD-WoID sample only. ToM performance significantly and independently differentiated many, but not all, ASD-WoID and TD participants above and beyond the effects of working memory and inferential thinking. Neither working memory nor inferential thinking measures impacted ASD-WoID identification, but the former differentiated the diagnostic samples. The findings were consistent with the hypothesis that ToM performance is associated with domain-general cognitive abilities such as working memory and inferential thinking in ASD-WoID. However, the findings also support the idea that ToM deficits in ASD-WoID are not solely explained by impairments in more general cognitive abilities.

| Jessica Soto |

Major: Neurobiology, Physiology, & Behavior
Minor: Public Health Sciences

Mentor: Dr. Marcella Gonsalves

Research Type: UHP Thesis

The Disproportionate Effects of the COVID-19 Pandemic on the Latinx Community's Physical, Financial, and Mental Health

Health disparities, defined as differences in health outcomes across different groups of people, have long been acknowledged as a problem in the United States. These disparities are driven by social determinants of health: conditions in the environments in which people are born, live, learn, work, and age. More specifically, individuals within the Latinx community face many health disparities due to their environments and barriers to healthcare. These health disparities may have been exacerbated by the COVID-19 pandemic. A literature review was conducted using scholarly and reputable gray literature in order to identify how the COVID-19 pandemic affected the Latinx community's health and economic situation and to define potential underlying reasons. Preliminary findings may suggest that members of the Latinx community are more likely to have jobs that put them at greater risk for contracting COVID-19 and to experience a decrease in wages or job loss. Identifying health disparities during a pandemic allows the public health community to better understand the effects of the pandemic and to address these effects during and after the pandemic.

| Mukul Sharda |

Major: Neurobiology, Physiology & Behavior

Mentor: Dr. Ben Reeb

Research Type: UHP Thesis

Paternal Anxiety as a Predictor of Change in Youth Anxiety Across Time

Anxiety disorders are among the most prevalent and debilitating psychiatric problems affecting adolescents and young adults. Fathers have been underrepresented in research on the intergenerational transmission of anxiety, despite growing evidence that anxiety runs in families. Using prospective data from a community sample of 451 adolescents (49% female) from heterosexual two-parent families, the aim of this study was to investigate the unique effects of paternal SCL-90-R anxiety symptoms on youth anxiety symptoms from adolescence (age 13) to early adulthood (age 21). Using autoregressive multiple regression analyses, paternal anxiety was examined as a predictor of change in youth anxiety across time. Statistical controls included maternal anxiety, maternal and paternal depressive symptoms, youth sex, and family socioeconomic status. Because previous research has documented sex differences in anxiety problems, youth sex was examined as a moderator of associations between father and adolescent anxiety symptoms. Father anxiety symptoms predicted adolescent anxiety symptoms, but only among father-daughter dyads. These findings add to a growing literature on fathers' role in adolescent psychopathology and highlight the importance of further research on how and under which conditions anxiety is transmitted from one generation to the next.

| Kiyomi Sun |

Major: Neurobiology, Physiology, & Behavior
Minor: Psychology

Mentor: Dr. Dave Furlow

Research Type: UHP Project

Expanding Students Opportunities in Biodesign

Biodesign is a growing, multidisciplinary field that aims to create more sustainable products by exploring biological mechanisms to solve global issues. The aim of this research project is to discover optimal ways to get students interested in and involved with biodesign, as well as support their efforts to turn their ideas into careers. This ongoing research will utilize interviews with educators in fields related to biodesign, programs such as the Biodesign Challenge that inspire biodesign innovation, as well as students and entrepreneurs who are currently working on biodesign products. Based on the information gathered from these sources, interactive problem-solving workshops and interview videos illustrating the design process will be created. These resources will help educators determine the best types of programs, such as implementing a biodesign major or minor, or implementing a problem-based approach to biodesign in course activities, would best benefit their students, and inspire them to further develop their ideas.

| Camille Tenyenhuis |

Major: Neurobiology, Physiology, & Behavior

Mentor: Dr. Luca Comai

Research Type: UHP Thesis

Genes, Transposons, and Recombination in Selected Plant Genomes

Chromosomes are complex genetic structures containing identifiable elements such as genes and transposons. During Prophase I of meiosis, homologous chromosomes can exchange segments through the process of recombination. It is not entirely clear how genes and transposons affect recombination. Previous studies in plants and animals have shown that along a chromosome, recombination frequency tends to be positively correlated with genes and negatively correlated with transposons. Chromosomes can differ in number, size, and composition between the genomes of different species. Understanding how the density of genes, transposons, and recombination events vary within chromosomes of different size and organization is important because these properties affect genome maintenance and evolution. Here we show the comparative distributions of genes and transposons within the chromosomes of three plant species: *Arabidopsis thaliana*, *Solanum tuberosum*, and *Solanum lycopersicum*, as well as the distribution of recombination frequency in *A. thaliana* and *S. lycopersicum*. We found an inverse relationship between gene and transposon density. Additionally, we found a positive relationship between gene density and recombination frequency in the two species where this was examined. Our results confirm past findings in other species that show a relationship between genes, transposons, and recombination frequency in plant genomes.

| Angela Wu |

Major: Neurobiology, Physiology, & Behavior

Minor: Asian American Studies

Mentor: Dr. Kyria Boundy-Mills

Research Type: UHP Thesis

Conversion of almond hull hydrolysate to protein-rich material using yeast

Yeasts are unicellular fungi that consume sugar to produce their cellular components. Some yeasts are currently used in livestock feed as a high protein supplement. These yeasts are unable to utilize the sugar galacturonic acid, a monomer of pectin, efficiently. Galacturonic acid is a dominant carbon source in almond hulls, low value by-products produced during almond harvesting. The goal of this research was to identify yeasts that can metabolize a large proportion of almond hull carbon compounds while producing high amino acid concentrations essential for animal feed. By doing so, we will be able to reduce almond industry waste while maximizing sustainable sources of protein for livestock. The Phaff Yeast Culture Collection at UC Davis contains over 1,000 yeast species which allowed for the selection of strains based on promising characteristics such as the potential to accumulate high protein concentrations. They were screened in laboratory media with nutrients found in processed almond hulls, then cultured in real almond hull hydrolysate. Then, we determined the total protein and amino acid composition. We found that two strains were able to successfully consume galacturonic acid in lab media and are continuing to confirm its ability to do so in real almond hull hydrolysate. My part in this study focused on collecting yeast growth data through different methods for the creation of correlation plots used to estimate the mass of yeasts grown on almond hull media rather than lab media.

| Minh-Thu Truong |

Major: Biological Sciences

Minor: Statistics

Mentor: Dr. Cynthia Schumann

Research Type: UHP Thesis

Synaptic Density Analysis with Array Tomography in Human and Non-Human Primate Amygdala

Although evidence is still minimal, there has been increasing recognition of the role the amygdala plays with autism spectrum disorder (ASD). Our primary goal is to map synaptic density, both excitatory and inhibitory, of the human and non-human primate amygdala across age. With this new data, we may also determine how the neural trajectory differs in the brains of patients with autism, and how synaptic density may differ in monkeys prenatally exposed to maternal immune activation (MIA model). The subjects will likely begin as non-human primate models, but we are in the midst of finalizing the protocol for collecting human samples. The method of mapping synaptic densities will be done with array tomography (AT), a newly developed microscopy tool that detects antibodies against synaptic molecules. Array tomography outputs 3-dimensional, ultra-high resolution images of resin embedded tissue sections that have been stained with fluorescent antibodies. Our plan to quantify synaptic density in the amygdala begins with manually adjusting the array tomography R-program to fit our synaptic size, tissue type, and machinery. We hope that with AT, mapping the developmental trajectory of the amygdala across age groups will further our understanding of ASD.

| Nasim Zeighami |

Major: Genetics & Genomics

Mentor: Dr. Gerald Quon

Research Type: UHP Thesis

Determining the Effect of Various Compounds on Gene Regulation

Current treatment of cancer relies significantly on the use of targeted therapeutics. There are a multitude of compounds with diverse primary targets developed for a number of different tumor types. Unfortunately, these compounds tend to have off-target effects. Specifically, the effect these compounds may have on gene regulation is still unknown. Understanding the effect of compound exposure on transcriptional regulation in cancer cells would provide insight into which genes and pathways might be directly targeted by each compound. Towards this goal, we analyzed transcriptional responses of three cancer cell lines (A549, K562, MCF7) to a large panel of 188 compounds, exposed at five different compound concentrations. We calculated the number of differentially expressed genes observed for a given cell line exposed to pairs of compound concentrations, across all compounds. The data from the K562 cell line revealed that out of the 188 compounds studied, 39 of the compounds elicited a significant differential gene expression response in at least 10 genes, suggesting the concentrations of compounds tested was physiologically appropriate for this subset of compounds. These 39 compounds cover approximately 20 classes of compounds. HDAC inhibitors seemed to be the most prevalent of these 20 classes identified.

College of
Engineering



| Raymond Chan |

Major: Computer Science & Engineering

and Psychology

Mentor: Dr. Xin Liu

Research Type: Engineering Design Project

Engineering Senior Design - Resume Scanner

Resume Scanner is a program that extracts personal information about a person based on what they had put on their resume using the OCR and ML approach. Resume Scanner is intended to be used by company recruiters who need to process 1000s of resumes for every set of job positions. It offers an automated method for recruiters to selectively filter out resumes that do not meet the job requirements. The product is fast, free, and able to handle even resumes in formats that are out of the industry norm. Furthermore, Resume Scanner's source code is open source, and the personal information extracted from each resume is programmed to save into a MySQL database the user indicates they owned. In other words, Resume Scanner's users can tailor the product's source code as they see fit, and use the product as part of the back-end of their large-scale application.

| Alyssa Escoto |

Major: Biomedical Engineering

Mentor: Dr. Jennifer Choi

Research Type: Engineering Design Project

Biomedical Engineering Senior Design Project

| James Melkonian |

Major: Mechanical Engineering

Mentor: Dr. Johnathan Schofield

Research Type: Engineering Design Project

Target LRU Assembly Fixture

The Lawrence Livermore National Laboratory (LLNL) is a research facility funded by the federal government. One of the many laboratories at LLNL is the National Ignition Facility (NIF). NIF holds the world's most powerful laser with the purpose of achieving nuclear fusion through laser energy. The laser is used for hundreds of experiments per year. Many experiments require cryogenic temperatures. These experiments require fitting the sample (called the target elsewhere in this report) onto an ignition target inserter cryostat (ITIC). The ITIC holds the target in place during the experiment and provides cooling, and thermal isolation. With current procedures, target installation can take anywhere from eight to twelve hours limiting the number of experiments (called shots) that can be conducted per day. As part of an attempt to increase shot frequency, NIF engineers are designing a target line replaceable unit (LRU) that only requires one to two hours of inline installation time. For this new procedure, the LRU is assembled and prepared in an offline facility reducing inline installation time dramatically. This project provides a design for an LRU assembly fixture. This fixture provides a safe environment for target installation onto the LRU as well as holding the target for optical quality assurance (QA) procedures.

| Alisha Miller |

Major: Biomedical Engineering

Minor: History

Mentor: Dr. Jennifer Choi

Research Type: Engineering Design Project

Engineering Senior Design Project

The objective of this project is to aid clinicians in handling the increase in use of the prone position due to the COVID-19 pandemic and limit the occurrence of pressure related injuries in COVID-19 patients in the prone position. Our aim is to develop a device that is durable, autonomous (reliable without the need for continuous check up), cost-effective and able to alleviate pressure over long periods of time, especially in the facial regions. Through our aim, we hope to help not only clinicians but any personnel who is dealing with COVID patients and respiratory illnesses. The assumptions associated with the use case of our device is that the adult patient is sedated, intubated, and prone for an extended period of time.

| Michael Puso |

Major: Aerospace Science & Engineering and
Mechanical Engineering
Mentor: Dr. Case van Dam
Research Type: Engineering Design Project
Engineering Senior Design Project

| Kathryn Tarver |

Major: Biological Systems Engineering
Mentor: Dr. Md Shamim Ahamed
Research Type: Engineering Design Project
**Effect of Shape and Orientation on the Thermal Performance
of Greenhouses in the Western USA**

Crop production in a controlled environment setting in Mediterranean regions has become popular due to the increased negative impacts of climate change. However, the greenhouse energy costs, especially the costs for heating and cooling, depend heavily on the greenhouse's shape and orientation. Previous studies recommended various shapes and two different greenhouse orientations for greenhouse all over the world. A quasi-steady state thermal model known as GREENHEAT was developed to simulate conventional greenhouses' hourly heating requirements over a year. Currently, GREENHEAT model does not address the transient air turnover rate due to ventilation in the greenhouse, which could significantly affect energy-demand, especially under cooling mode. To account the effect of varying air exchange, the study will create a ventilation sub-model to simulate the required ventilation to control the temperature and relative humidity in the greenhouse. This study aims to analyze the effect of five different greenhouse shapes and orientation on energy costs in three climates representing major agricultural regions in California.

| Anika Varma |

Major: Chemical Engineering and
Biochemical Engineering
Mentor: Dr. Karen McDonald & Dr. Somen Nandi
Research Type: Engineering Design Project
**Bioprinting transgenic plant cells for production of a
recombinant biodefense agent**

Transgenic rice cells (*Oryza sativa*) producing recombinant butyrylcholinesterase (BChE) as a prophylactic/therapeutic against organophosphate nerve agent poisoning, cocaine toxicity, and neurodegenerative diseases like Alzheimer's were immobilized in a polyethylene glycol-based hydrogel. The cells were sustained for 14 days in the semi-solid matrix, undergoing a growth phase from days 0-6, a BChE production phase in sugar-free medium from days 6-12, and a growth/recovery phase from days 12-14. Throughout this period, the cells maintained similar viability to those in suspension cultures and displayed analogous sugar consumption trends. The rice cells in the bioprintable hydrogel also produced a significant amount of active BChE, comparable to the levels produced in liquid cultures. A considerable fraction of this BChE was secreted into the media, allowing for easier product separation. Overall, we demonstrate a simple, efficient, robust, modular, and potentially field-deployable bioreactor system for the manufacture of biologics. This project provides a design for an LRU assembly fixture. This fixture provides a safe environment for target installation onto the LRU as well as holding the target for optical quality assurance (QA) procedures.

| Nichole Yacoub |

Major: Chemical Engineering
Mentor: Dr. Jason White
Research Type: Engineering Design Project
**Sustainable Production of Isopropanol and
Acetone Using Propane**

Isopropanol and acetone are industrially significant chemicals with a wide variety of applications, such as in chemical solvents, pharmaceuticals, and personal care products. The emergence of the COVID-19 pandemic led to a surge in isopropanol demand in particular as hand sanitizers and cleaners sales peaked. Currently, both chemicals are derived from the indirect catalytic hydration of propylene, which is a key product of the petroleum refining process. Unfortunately, the shift towards shale gas production has led to a sharp reduction in propylene availability and a consequential rise in its market price. Thus, an opportunity has been identified to select a cheaper feedstock, propane, to increase isopropanol and acetone abundance and reduce the cost of the products in which they are used. This engineering design project presents a two-step process in which propane is partially oxidized to an acetone-rich mixture of acetone and isopropanol in the presence of a Au/TS-1 catalyst, which is then further oxidized in the presence of a Cu-Al catalyst to improve isopropanol selectivity. An advantage of this process is that it may be adjusted on-site to achieve flexible ratios of acetone:isopropanol production rates, reaching a total of 40,000 tonnes each operating year (335 days). As work on this design simulation continues, plans for carbon dioxide capture and efficient use of cooling and heating streams within the plant will hopefully result in a profitable, environmentally-conscious process.

College of Letters
and Science



| Danielle Baza |

Major: History

Minor: Native American Studies

Mentor: Dr. Greg Downs

Research Type: Honors Thesis in Major

California Fever: Madness in Gold Rush Era California

The development of California's mental institutions coincided with the birth of a new state, one that blossomed out of disarray and in face of a sudden influx of people. Nineteenth century popular culture and doctors defined "insanity" in extremely ambiguous terms, effectively construing mental illness as any behavior that disrupted society. Through the lens of writings by Dr. Robert Reid, resident physician of the Stockton State Hospital, my work examines one perception of mental illness and the way that California's approach to mental health created an atmosphere of instability for newcomers to the state. The quickness in which California transformed from being newly ceded and sparsely populated land from Mexico to a state with an ever-increasing population meant that California's rudimentary legislature had no time to form a contingency plan tailored to the needs of its populace. The unique social settings in gold country, with the lack of the nuclear family and instead, the prevalence of homosocial camps with men of different ethnicities, threatened the fragile morality of the new state. California doctors and legislative representatives institutionalized social outcasts prone to drunkenness or dissipation, or because of religious fervor or unemployment, with the intent to reform them.

| Victoria Beck |

Major: Mathematics

Mentor: Dr. Laura Starkston

Research Type: Honors Thesis in Major

Relations on the Mapping Class Monoids of Surfaces

The mapping class group of a surface is a set of functions which continuously bend and stretch the surface, called homeomorphisms. In the mapping class group, two homeomorphisms are considered to be equivalent if they are isotopic to one another. Furthermore, homeomorphisms of the annulus that fix the boundary pointwise are called Dehn twists, and products of Dehn twists along simple closed curves in any surface generate the entire mapping class group of that surface. Using the swing presentation, Margalit and McCammond have previously defined a complete set of relations on the mapping class group. In this project, we consider the elements of the mapping class group that can be generated only by positive Dehn twists, which form the mapping class monoid. We aim to define new relations on the mapping class monoid of a genus 0 surface in order to determine when two elements are equivalent. This information can be used to analyze Lefschetz fibrations, which build 4-dimensional spaces with boundary using surfaces together with products of positive Dehn twists around simple closed curves. In particular, the boundaries of two Lefschetz fibrations are homeomorphic if their associated products of Dehn twists are equivalent in the mapping class monoid.

| Vanessa Cardona-Ocegueda |

Major: English and History

Minor: Chicano/a Studies

Mentor: Dr. Maceo Montoya

Research Type: UHP Thesis

Fragments: Living as a Chicana Woman in the 21st century

In literature, Chicanx/Latinx voices are still limited compared to the large amount of English/Western content we find. *Fragments: Living as a Chicana Woman in the 21st Century* is a collection of stories that attempts to document the struggles of young Chicanx people as they come to understand how their experiences, their culture, their language, etc. may intersect and affect their identity. *Fragments* follows the life of a young Chicana woman as she tries to come to terms with how her identity as a "Mexican-American" complicates her relationship with her family and other relationships she forms. This work attempts to expand the scope of available Chicanx/Latinx literature by using Chicanx narrative forms. The work builds on previous understandings of Chicanx/Latinx identity but adds reflections of 21st-century scholarship and social norms. The work is largely autobiographical in content so the hope is that this narrative will help expand other people's interest in documenting their own narratives so there are more Chicanx/Latinx voices in literature.

| Trevor Carpenter |

Major: Computer Science and Statistics

Mentor: Dr. Setareh Rafatirad

Research Type: UHP Thesis

U.S. 2020 Twitter Analysis: A Knowledge Extraction of Events and Public Reception

In the age of social media, Twitter is a medium for the everyday person to not only voice their opinion on large topics, but also connect with and influence thousands as a result. In 2020, a year of elections, lockdowns, and vast differences of opinion, Twitter was ranked 4th in the world for engagement as external influence through social media resulted in historical events that weren't all positive. In this research we utilize Machine Learning and Data Science techniques to analyze tweets throughout the year and visualize their correlation with large events and public reception. The project emphasizes the use of algorithms for the purpose of finding what influences people; whether that is classifying harmful bots that spread misinformation or analyzing text sentiment to quantify the attitude of users. The research is currently in progress, but preliminary results suggest a strong polarization of opinions throughout the year, as well as an increase in misinformation spreading twitter bots. Our goal is to use this research to warn about the harmful influence of social media in polarizing people's opinions on political topics.

| Eric Coyle |

Major: Neurobiology, Physiology, & Behavior and Spanish
Minor: Wildlife, Fish, and Conservation Biology

Mentor: Dr. Robert Irwin

Research Type: Honors Thesis in Major

Transformative Voices

So often transgender individuals are burdened by improperly used generalizations, subject to discrimination and prejudices arising from deeply rooted transphobia, and characterized by negative health outcomes (e.g., HIV risk) that affect them disproportionately but do not define them. I investigated personal testimonies and contextual information from media and published academic sources to capture the perspectives and stories of the transgender communities in Mexico and Peru. Society too often focuses on numbers and statistics, overlooking the human element of marginalized populations, so sharing the voices and aspirations from within those communities is key for social progress. By using the insight of those directly impacted by social injustice, allies of the transgender community and social activists in general can create broad alliances and develop effective campaigns targeting both the root causes and the various manifestations of social injustices. Specifically, for the transgender communities in question, efforts must increase the visibility and appreciation of transgender individuals across society, prevent the continued pathologizing and stigmatization of different gender identities, and move on from narrow perceptions of gender based on binary concepts that fail to reflect the natural diversity of humanity.

| Joseph Cruz |

Major: Pharmaceutical Chemistry

Mentor: Dr. Justin Siegel

Research Type: UHP Thesis

Computational Design of HMG-CoA Reductase Inhibitors

The drug family known as statins are inhibitors of hydroxymethylglutarate-CoA Reductase (HMGR) enzyme in humans. HMG-Coa Reductase is responsible for catalyzing the committed step in cholesterol biosynthesis. Inhibiting HMGR via statins has shown to reduce cholesterol levels in individuals with hypercholesterolemia. This study derives two novel small molecules by evaluating four commonly prescribed statin medications: simvastatin, atorvastatin, fluvastatin, and rosuvastatin. A library of structural conformers were created for each small molecule and were docked into the active site of HMGR in humans and given a docking score. Among these four inhibitors, fluvastatin exhibited the strongest binding effect with a score of -12.46. From this result, fluvastatin was designated as the lead molecule and two new molecules were designed from it using computational and hypothetical methods. Preliminary results of these newly designed drugs produced marginally better docking scores of -14.29 and -13.34 respectively. Slight changes in ADMET properties in the new molecules were also observed, as well as minor improvements to drug-enzyme interactions, likely resulting in the improved docking scores over the lead molecule. Future work will improve upon these scores and explore how Single Nucleotide Polymorphisms (SNPs) may affect inhibitor binding.

| Meghan Crebbin-Coates |

Major: Science & Technology Studies,
Theatre & Dance, and Art Studio

Mentor: Dr. Colin Milburn

Research Type: Honors Thesis in Major

A Textual Analysis of Influences in University Nutrition Curriculum Textbooks

Studies have shown that various outside influences and biases are present in science textbooks for elementary and high school students including industry and personal beliefs of review committees. These biases are particularly prevalent in socially controversial topics such as climate change, sex education, and nutrition and health. Less research has been conducted on the presence of bias in science textbooks written for university and college students. This paper examines six university nutrition textbooks and explores four socially controversial primary themes and their framing in relation to media and societal disputes through textual analysis.

| Christine Daniels |

Major: Classical Civilization

Mentor: Dr. Timothy Brelinski

Research Type: Honors Thesis in Major

Heeding Hesiod: Cautionary Tales for Iron Age Men in the Theogony and the Works and Days

Though numerous scholars have analyzed Hesiod's narrative of the creation of the first woman, later named Pandora, and of mankind, the Myth of the Ages of Men, there is still much about their meaning that is disputed. To be sure, the creation of Pandora partly explains mankind's current state, one of a decline from former bliss, and one in which daily work is essential for survival. But why Hesiod, immediately after narrating Pandora's creation, proceeds to tell the story of mankind's origins from the beginning, in a sort of hysteron proteron arrangement, is at first sight unclear. The key to understanding the connection of the myth of Pandora with the Ages of Men is the Iron Age. While many scholars have traditionally interpreted the Myth of Ages as simply a story of decline that ends with the least valuable metal, it is better to treat the Iron Age as separate from the preceding four ages and one whose future fate is not fixed but that will be determined by the poet's audience and their reception of his advice.

| Julie Daseking |

Major: Human Development and Design

Mentor: Dr. Nicole Sparapani

Research Type: UHP Thesis

Self-Regulatory Adaptable Desk

Emotion regulation (ER) refers to the capacity to monitor, evaluate, and manage one's emotions and physiological arousal to meet the demands of an activity or accomplish a goal. Within a classroom environment, students are expected to maintain an optimal state of physiological arousal to engage in learning. Although students often utilize an array of self-regulatory behaviors to help stay well-regulated, such as rocking or standing, classroom seating is typically not designed with this in mind. For instance, a student who benefits from vestibular sensory input cannot easily rock their four-legged or attached-to-desk chair. To help students meet their regulatory needs, this project focused on designing a desk that is adaptable to promote self-regulation, focus, and executive function skill development in students with varying learning needs. The first step included conducting a comprehensive review of the literature on ER across populations and stages of development and exploring options for flexible classroom seating. Next, K-12 and college students, teachers, and parents volunteered to complete a 10-question survey to gather input on their seating preferences. The literature review and survey data were then used to inform the design and development of a "sensory friendly" desk for K-12 classrooms.

| Rachel Drizin |

Major: Sociology and History

Mentor: Dr. Ryken Grattet

Research Type: Honors Thesis in Major

Investigating Narrative Legal Consciousness Among Legal Aid Workers

Legal consciousness is a critical concept in legal sociology. It addresses the ways in which the legal system maintains legitimacy and explores the key ways in which laypersons contribute to the function and structure of law. Recognizing that contribution, this study seeks to further analyze the function of law and legality within legal institutions themselves by applying the legal consciousness framework developed by Patricia Ewick and Susan Silbey in the book *The Common Place of Law: Stories from Everyday Life* in combination with access to justice and transformation of disputes literatures. As legal aid workers serve low-income individuals that often lack legal access, examining this population provides insight into the function, social power, and understanding of law at its margins. Interviews ranging from 45 minutes to 2 hours will be conducted with 15-20 legal aid workers. These data will be analyzed for the four elements of legal consciousness identified by Ewick and Silbey: normativity, constraint, capacity, and locality of law. Interviews and analysis are ongoing, but early analysis indicates the presence of both multiple legal consciousnesses, consistent with existing literature, and unique forms or variants of previously identified legal consciousnesses.

| Lindsay Goddard |

Major: American Studies

Minor: Education and History

Mentor: Dr. Eric Smoodin

Research Type: Honors Thesis in Major

Upholding the Disney Utopia Through American Tragedy: A Study of The Walt Disney Company's Responses to Pearl Harbor and 9/11

Since its founding in October 1923, The Walt Disney Company has endured as an influential preserver of fantasy, traditional American values, and folklore. As a company created to entertain the masses, its films often provide a sense of escapism as well as feelings of nostalgia. The company preserves these sentiments by "Disneyfying" danger in its media to shield viewers from harsh realities. Disneyfication is also utilized in the company's responses to cultural shocks and tragedies as it must carefully navigate maintaining its family-friendly reputation, utopian ideals, and financial interests. This paper addresses The Walt Disney Company's responses to two attacks on US soil: the bombing of Pearl Harbor in 1941 and the attacks on September 11, 2001 and examines the similarities and differences between the two. By utilizing interviews from Disney employees, animated film shorts, historical accounts, insignia, government documents, and newspaper articles, this paper analyzes the continuity of Disney's methods of dealing with tragedy by controlling the narrative through Disneyfication, employing patriotic rhetoric, and reiterating the original values that form Disney's utopian image. Disney's responsiveness to changing social and political climates and use of varying mediums in its reactions to harsh realities contributes to the company's enduring reputation and presence in American culture.

| Anna Guillermo |

Major: Art Studio, Design, and Managerial Economics

Minor: Accounting

Mentor: Dr. Bryce Vinokurov

Research Type: UHP Thesis

Educational Art Films

| Xander Goldman |

Major: International Relations

Mentor: Dr. Jonathon London

Research Type: UHP Thesis

Water Shortages, Lithium Mining, and The Indigenous Community in San Pedro de Atacama The Impact of Profit Maximizing Behavior on Atacameño Tradition

To many, electric vehicles symbolize an important step toward an environmentally sustainable future. The lithium used in EV batteries, however, carries a heavy social cost. The water intensive process by which lithium is mined has rapidly depleted the water table in Chile's Atacama desert, which is home to the most extensive lithium reserves in the world as well as the indigenous Atacameño people. This paper seeks to understand the impact that lithium extraction has on the indigenous population of San Pedro de Atacama, and how water is managed in this fragile ecosystem. Videos of panel discussions, news articles, academic literature, and social media pages were analyzed to shed light on the above topics. Findings emphasize that water shortages are causing irreversible cultural damage to the Atacameño community. Economic motivations at the state and corporate levels guide how water is managed and distributed in the interests of national and global capital in ways that interfere with intergenerational traditions.

| Michael Gutierrez |

Major: Spanish

Minor: Education and Public Health Sciences

Mentor: Dr. Eddy Ruiz

Research Type: UHP Thesis

Counterstories of Honors Students of Color

This project aims to explore and document the experiences of high-achieving students of color in university honors programs. The methods utilized in this research are both quantitative and qualitative in nature, with 5 interviewees of color being selected from a pool of about 40 survey participants. The results indicate that a majority of interview participants agreed that more diversity and representation was needed in honors, and that it was often difficult to find a community of people within honors who understood and could relate to their racial/ethnic, cultural, and/or socioeconomic backgrounds. Numerous participants recalled almost dropping out of honors altogether, and many experienced feelings of racial tokenization, alienation from peers, and impostor phenomenon. Overall, the findings elucidate the pressing need for university honors programs to recruit more students from underrepresented backgrounds and to provide targeted resources to support these students in developing a sense of community and belonging within honors.

| Oceana Haaland |

Major: Political Science

Minor: Geology and Human Rights

Mentor: Dr. Daniel Kono

Research Type: Honors Thesis in Major

Increasing Climate Action: Social Welfare Spending and Climate Change Opinion

Climate change is one of the most important issues facing the world, yet public opinion towards climate change varies across countries. Why certain publics are more supportive of climate action than others is an unanswered question within political science research. In this article, I examine the role of social welfare on climate public opinion by comparing state social expenditures and aggregate public opinions across different countries. I hypothesize that voters who may be negatively impacted by environmental regulations are more likely to support those policies and believe climate change is a threat if they are socially protected through welfare systems and unemployment benefits. I test my hypothesis by comparing state social expenditures and unemployment spending to aggregate public opinions through a cross-national analysis. Through regression modeling I find my results to be generally supportive of my hypothesis, that constituents of social welfare states are more likely to be in favor of climate action legislation because they are compensated for the negative impacts that those policies may have. Thus, my research may offer increasing social welfare benefits as a potential solution to increasing positive public opinions towards climate change, and perhaps environmental policy.

| Sabrina Habchi |

Major: Political Science and Psychology

Minor: Sociology

Mentor: Dr. Erik Engstrom

Research Type: Honors Thesis in Major

American Politicians of Middle Eastern Descent: Examining Voter Assessment of Competence

Middle Easterners in the U.S. are often referred to as America's invisible minority, since they are marked by the U.S. Census as Caucasian, but often do not benefit the same way as those of European descent. In fact, despite the complexities of Middle Easterners' ethnic and racial compositions, individuals within this racial group are often characterized as Muslim even when this may not necessarily be the case, which may further affect how Middle Easterners in the U.S. are treated given the present day's hostile political climate towards Muslims. This study will examine whether women of Middle Eastern descent who run for political office in the U.S. are appraised differently by voters in terms of competence than white women and men who run for office. This will be assessed by presenting participants with hypothetical candidates, including a small statement and picture, of either a white man, white woman or Middle Eastern woman and assessing their responses in regards to believed competency and willingness to vote for this candidate. Participants in each condition will be given the exact same information about the candidate, with only the name, sex and racial background manipulated.

| Alisha Hacker |

Major: American Studies and
Political Science – Public Service

Mentor: Dr. Scott MacKenzie
Research Type: UHP Thesis

What Makes a Successful Legislator in the California State Legislature

The California State Legislature is one of the most influential policy chambers in the country. California has 40 million citizens and is the 6th largest economy in the world, which makes the decisions made in Sacramento very important. Being an effective legislature in the California State Legislature can allow a member to pass significant and influential legislation. This paper defines what qualities the most effective legislators in California State Legislature possessed during different times in the last two decades. With this information, I created a profile of qualities that a successful legislator possesses by analyzing which legislators passed the most and the least bills. Then I looked to see which characteristic legislators performed above average mutually possessed. I looked to see if members with law degrees, women, who have served above-average years in the legislature or Democrats had a significant advantage relative to the overall share of that group in the legislature.

| Brett Hodges |

Major: Chemistry
Minor: Materials Science

Mentor: Dr. Frank Osterloh
Research Type: Honors Thesis in Major

Measurement of the Space-Charge Region Width in BiVO₄ and BiVO₄:Mo Particle Films with Surface Photovoltage Spectroscopy

Bismuth vanadate (BiVO₄) is an n-type semiconductor that shows great promise as a high-efficiency water oxidation catalyst for photocatalytic water-splitting, especially when doped with Mo to suppress electron-hole recombination. When water-splitting catalysts like BiVO₄ are placed in contact with a metal or redox solution, majority charge carriers are transported across the metal/liquid-semiconductor interface to establish equilibrium. This depletes the semiconductor and forms a depletion/space-charge region (SCR). Charge partitioning at the interface generates an electric field within the SCR, improving the mobility of minority charge carriers and directing them to the interface for useful electrochemical work. A recent study has demonstrated that surface photovoltage spectroscopy (SPS) is capable of probing properties of the SCR in semiconductor nanoparticle films. Observed SCR widths in these systems significantly exceeded theoretical values due to surface state-mediated Fermi level pinning. Equilibration of the semiconductor Fermi level with chemisorbed oxygen surface states prior to film deposition decreased the concentration of majority charge carriers within the particles, increasing the SCR width. In this work, SPS is utilized to probe the SCR width in BiVO₄ and BiVO₄:Mo films prepared upon gold substrates through anodic electrophoretic deposition. Following thermal annealing, negative SPS signals are obtained for BiVO₄ films with thicknesses greater than or equal to 1.1 μm, suggesting the SCR width in the Au/BiVO₄ system is less than 1.1 μm. A reduced negative photovoltage for the 1.1 μm film further implies that the SCR width is closer to 1.1 μm than the theoretical bulk value. Surface state-mediated Fermi level pinning to surface adsorbed oxygen states is tentatively proposed to explain this observation. SPS characterization of the Au/BiVO₄:Mo system is currently underway.

| Jarod Heng |

Major: Cinema & Digital Media and Computer Science
Minor: Psychology

Mentor: Dr. Andrew Smith
Research Type: UHP Project

Heng is Cambodian for Luck

I am the child of two immigrants from Southeast Asia. My father and his family escaped the Cambodian Genocide, and I grew up hearing the stories. However, throughout all my years in the American education system, recent history, especially surrounding the Cold War in Southeast Asia and the lives it uprooted, barely seemed to get a passing mention. Combining historical research, personal interviews, and my own knowledge, I created a short narrative documentary of how my father's family escaped the Cambodian Genocide and came to America, accompanied by a historical prelude. When the Khmer Rouge under Pol Pot defeated the Cambodian monarch and government forces, they began a long campaign to create a nationalist agrarian communist "utopia" by murdering and displacing millions. In the chaos, my father's family, alongside the rest of the urban populace, were forced to march to the countryside and jungles to resettle. From their small drug store to the perilous jungles of Cambodia, the documentary details my father and his family's memories of how they escaped the Cambodian Genocide, and eventually came to settle in the United States.

| Aditi Hosangadi |

Major: Psychology
Minor: English

Mentor: Dr. Lindsay Bowman
Research Type: Honors Thesis in Major

Facial Emotion Perception and Theory of Mind in Preschool Aged Children

Many theorists have suggested that the early perceptual processing of emotional faces could play a role in the later understanding of emotions and other mental states. However, research exploring this relationship has been lacking. Previous research has highlighted the preschool years as an important period of development for theory of mind (ToM), the ability to understand and reason about others' mental states. The present study aims to explore the connection between theory of mind and emotion perception in preschool children. We recorded electroencephalogram (EEG) data while participants viewed emotional faces and used the modulation of the N170, a face-sensitive event-related potential (ERP) component, as a measure of emotion perception. We assessed ToM via two measures: the Simplified Eye Reading Test (SERT), which asks children to determine emotional state based on pictures of eyes, and Wellman and Liu's mental state reasoning task battery (2004). We hypothesize that greater N170 modulation in response to emotion will correlate with greater ToM scores on both measures and that the correlation will be stronger with mental state decoding (SERT) than with mental state reasoning. The results could provide insight on emotion perception as a precursor of ToM and into differences between subcomponents of ToM.

| Laura Jett |

Major: Cognitive Science

Minor: Psychology

Mentor: Dr. Tamara Swaab

Research Type: Honors Thesis in Major

Effects of depression and anxiety on negative word processing

In the face of rising depression and anxiety, as well as unresolved questions from past research on cognitive bias in these disorders, this study aims to examine how depression and anxiety affect the processing of words with a negative meaning (e.g., grief). Specifically, I will compare participants across the spectrum of depression and anxiety on how they process negative vs. neutral words on measures of attention (emotional Stroop task), implicit memory (word naming), and explicit memory (recollection task). I will also evaluate potential modulating factors such as stimulus self-relevance and performance on a classic Stroop task. Prior literature suggests that while we may see attention and memory bias towards negative words overall for both anxious and depressed individuals, we may expect an even greater attention and memory bias towards negative words in these individuals for disorder-specific, self-relevant words. Such a finding would be important because negativity bias has been implicated as a risk factor for anxiety and depression. By comparing depression-related, anxiety-related, and uncategorized negative words, and by evaluating stimulus self-relevance, this study can assess whether there is bias towards negative information more generally, or if the bias is disorder-specific, which may have implications for future research and interventions.

| Gursimran Kaur |

Major: Political Science and Gender, Sexuality, & Women's Studies

Mentor: Dr. Rana Jaleel

Research Type: UHP Project

Gender Equity Podcast

Intersectional feminist spaces can often be difficult to navigate without prior knowledge of power dynamics caused by issues of race, class, gender, sexuality, disability, and more. Yet, in a contemporary sociopolitical climate that centers a need for social justice work, it is necessary to bring people into conversation who would otherwise not be involved in feminist discourse. This project seeks to create a resource for people hoping to enter feminist communities and build knowledge on introductory concepts in intersectional feminist thought. The goal is to create a resource in the form of a podcast by engaging in conversations with people doing gender equity and social justice work in the Davis community as well as professors who are doing scholarship on feminist topics. By making these often daunting ideas and conversations more accessible, the hope is that more people will feel empowered to enter feminist spaces and engage in very necessary social justice work.

| Michael Johnson |

Major: History

Mentor: Dr. Lisa Materson

Research Type: Honors Thesis in Major

The Changing Legal

and Social Definitions of Consent Between the 1980s and 2008 For Sex Crimes in the U.S. Justice System

The United States justice system is home to many errors and is subject to improperly written laws which not only negatively affects its citizens but makes it difficult for courts to interpret the law. One of those many errors is the changing definition of consent over time, specifically between the 1980s and 2008. My study examines the changing definitions of consent from the time of slavery in seventeenth century well into the twenty-first century to see how it affects court proceedings involving sex-related crimes. This study also looks at how these legal ambiguities surrounding the changing definitions around the U.S. may affect people of color accused of sex crimes, how it may lead to an improper conviction in the eyes of the law, and how that may pose a risk to other people who are accused of crimes of the similar nature.

| Tamyia Landers |

Major: Sociology and Psychology

Mentor: Dr. Jacob Hibel

Research Type: Honors Thesis in Major

Pandemic Homeschooling: How Will This Impact Children?

During this unpredictable time of COVID-19, there have been many sudden changes, some of which being related to the educational systems. Many schools have shut down for the remaining months of the 2019-2020 academic school year, and will continue to operate online as children progress through the 2020-2021 academic school year. Children are essentially being forced into homeschooling, which may leave some children falling behind in their school work. This qualitative research study explores children's educational progress and achievement as well as problems that the families face in their day to day lives in relation to the struggles brought on by COVID-19. This study involves semi-structured interviews, three per family, of four families in the US with elementary school aged children through a case study approach on the topics of educational progress, behavior, and access to resources, comparing before and after the pandemic. The findings of this study will be able to provide insight on the benefits and downfalls of education during the pandemic, highlighting issues that families and schools can work on.

| Giovanni Lara |

Major: Pharmaceutical Chemistry

Mentor: Dr. Roland Fallner

Research Type: Honors Thesis in Major

Determining the Binding

Affinity of SARS-CoV-2 Spike Protein Fragment to Heparin

This research aims to determine the binding affinity of a SARS-CoV-2 spike protein fragment to heparin through computational methods. Recent research[1] suggests that the glycosaminoglycan heparin which is also present in most mammalian cells may be able to bind to the SARS-CoV-2 spike glycoprotein, explaining observed lower transduction efficiency in cell culture when high amounts of heparin is present. To validate this interaction, a SARS-CoV-2 spike glycoprotein fragment and heparin are tested in silico to find binding affinity by measuring the relative distances between the molecules at various time points. Hydrogen bonding interactions between the two molecules are also mapped for better understanding of the interaction. Preliminary results in the form of a mean square displacement graph demonstrate that there has been a conformational change in the spike protein fragment induced by heparin. Data is currently being generated to map the hydrogen bonding network that exists between the spike protein fragment and heparin. High binding affinity may reveal potential in heparin and its derivatives as drugs to reduce transfection rates of SARS-CoV-2.

| Adrian Lopez Miramontes |

Major: Political Science

Minor: Communication and Religious Studies

Mentor: Dr. Adrienne Hosek

Research Type: Honors Thesis in Major

Ronald Reagan, Social Welfare, and the 1980's Recession

This qualitative study serves to paint a cohesive picture of how Ronald Reagan, and his administration, responded to the economic recession of the 1980's through the scope of changes to social welfare programs. I ultimately conclude that the largest changes were to traditional welfare programs, such as Medicare and Medicaid, and the largest population affected were single working women led families. I also conclude that, in comparison to Franklin D. Roosevelt, Reagan's actions were different in regard to helping corporations instead of being weary, but still providing help to the population they deemed needy. This ultimately produces questions regarding the changes to social welfare programs and when the largest changes occur.

| Stephanie Ly |

Major: Pharmaceutical Chemistry

Minor: Asian American Studies

Mentor: Dr. Jorge Pena

Research Type: UHP Thesis

Social Compensation or Augmentation:

Social Media Usage Augments Bicultural Individuals' Acculturation Stress and Bicultural Conflict

The popularity of social media sites and apps has stimulated research on how its habitual use is linked to increases or decreases in social capital, loneliness, and well-being. However, there is less research on how bicultural individuals use social media to navigate their belonging to two or more cultural groups. In particular, bicultural conflict describes the degree to which individuals perceive tension between their two identities. It has been correlated with their ability to shift between cultural lenses, acculturation stress, social network diversity, and mental health. An Mturk survey sample (N = 721) was recruited to explore the link between social media use, acculturative stress, and bicultural conflict. Path analyses indicated that, among bicultural individuals, intensity of social media use was positively associated with acculturation stress factors such as increased language skill difficulties, race-related work challenges, perceived discrimination, intercultural disagreements, and cultural isolation. In turn, these factors were associated with increased bicultural conflict. Social media use was also directly linked to augmented bicultural conflict. The results supported the social compensation hypothesis as they imply that bicultural individuals employ social media more intensely to cope with societal pressures but in doing so, experience increased acculturation stress and bicultural conflict.

| Rustin Mahboubi-Ardakani |

Major: Physics

Mentor: Dr. Daniel Cox

Research Type: Honors Thesis in Major

Computational Simulations of SARS CoV-2 spike proteins with antibodies with estimates of binding energies and potential antibody escape

The worldwide outbreak of SARS CoV-2 has highlighted the issue of achieving reliable binding of manufactured proteins to individual virus particles (virions) both for capture (in detection) and neutralization (in therapeutics or prophylactics). Computational physics tools such as molecular dynamics programs can be used to test binding affinities of amino acid polymers with the Covid spike protein in order to predict how effectively mutant strains will bind to proteins in vivo, or how effectively synthesized polymers can neutralize the Covid spike protein (and its mutants). Furthermore, these computational simulation tools can be used to predict how SARS CoV-2 will escape from antibodies produced in response to infection or inoculation, thus allowing us to understand how and why mutant strains such as the Brazil, South Africa, or UK strain escape from antibodies and increase infectivity. This will also allow us to prepare for not yet existing mutant strains by running simulations on edited proteins to determine if their binding affinities increase or decrease (simulated mutants with higher binding affinities could potentially evolve if such mutations do not impact the protein's function). Here, we use molecular dynamics programs such as YASARA to run simulations and gather information about hydrogen bonds and estimated binding energies, in addition to HawkDock, a server-based protein-protein binding energy estimation algorithm.

| Valencia Martinez |

Major: Communication
Mentor: Dr. Magdalena Wojcieszak
Research Type: UHP Thesis

Mass Media's Role in Political Polarization and Its Impact on the Social Fabric of US Society

The emergence of political polarization has been of great interest to many scholars in the humanities and social science field because of its impact on modern society's social cohesion. Mass media is a critical point of study because of its informative role in society and its capability to provide a platform to elite figures who could be driving the phenomenon. Thus, it has the ability and has proven to favor one party or ideology over another. Nonetheless, we can understand political polarization as the diverging of political attitudes to ideological extremes. This topic is usually discussed in the context of partisan polarization of Republicans and Democrats and democratic government systems. As a result, studies show that polarization can have negative consequences for democracy, political attitudes, mass opinion and mass consent, and even the personal lives of the mass media audience. This project attempts to outline and analyze essential findings in this area and provide proposed solutions for this growing issue.

| Molly Mermin |

Major: Pharmaceutical Chemistry
Minor: Political Science
Mentor: Dr. Justin Siegel
Research Type: UHP Thesis

Using Computational Methods to Design a Novel Small Molecule Neutrophil Elastase Inhibitor

Neutrophil elastase (NE) is a pro-inflammatory serine protease secreted by neutrophils, the most common type of white blood cells. Many studies have linked high NE activity to lung diseases such as Cystic Fibrosis (CF), bronchiectasis, Chronic Obstructive Pulmonary Disease (COPD), and Acute Respiratory Distress Syndrome (ARDS). Research has shown that inhibiting NE can lead to improved outcomes in patients with these diseases. Currently, there is only one small molecule NE inhibitor on the market, Sivelestat, though several others are in clinical trial. Sivelestat has had mixed success, and must be administered intravenously. We use computational methods to develop a novel small molecule inhibitor of NE with improved efficacy, and that could be administered orally or inhaled. A molecule library of drug candidates and their conformers was generated, then docked of the small molecule into the active site of the enzyme. Additionally, we will test the binding of the inhibitor on a different variation of the enzyme, to ensure efficacy in different populations. This work will potentially generate a novel drug candidate for pre-clinical trial to treat various chronic and acute pulmonary diseases

| Ann Meyer |

Major: English and History
Mentor: Dr. Kathryn Olmsted
Research Type: UHP Thesis

The Historical Context of QAnon

In 2017, an anonymous user began posting on the online image board 4chan, alleging conspiracies involving partisan politics and public figures in the U.S. These posts evolved into QAnon, a conservative movement founded on a complex web of conspiracy theories. Since the FBI classified QAnon a domestic terrorism threat in 2019, evident in its visibility at the insurrection on the U.S. Capitol, QAnon has gained footing in over 70 countries and garnered international media attention. Speculation into QAnon's origins and rapid spread prompts many questions, namely why did the movement arise and captivate millions of Americans?

My research undertakes these questions from a historical perspective. By contextualizing QAnon and its ideas about religion, race, patriotism, gender, and politics in U.S. history, I demonstrate that the movement is a new rendition of old beliefs and anxieties co-opted and applied to present-day society. In particular, I examine well-documented histories of fundamentalist and evangelical Christianity, white power movements, and the politicization and weaponization of conspiracy theories. I argue that QAnon and its ideologies are extremist variants of more "mainstream" elements of the New Right in the U.S. during the twentieth century.

| Shannon Meyer |

Major: Economics and Statistics
Mentor: Dr. Giovanni Peri

Tariff Uncertainty, International Productivity, US Manufacturing Employment

Public perception that international competition increasingly threatens US manufacturing jobs has recently shifted national attention toward anti-trade liberalization policies. This project examines US-China trade between 1990 and 2007 and takes a step towards quantifying the relative impact of trade liberalization policies in the context of an exogenous, foreign production shock. I combine established quantifiers of regional exposure to trade liberalization and production effects into a specification which estimates both simultaneously. Consistent with existing research and reasonable intuition, I find evidence of an important effect of both channels on regional and national manufacturing employment. Correlation between the two measures of exposure limits the findings; however, preliminary results suggest a larger relative impact of exogenous production shocks outside the control of US policymakers. Given the time and data constraints of this project, my results are tentative and intended only as a complement to the existing literature.

| Nadiah Mohammed |

Major: Design
Minor: Communication and Art History
Mentor: Dr. Magdalena Wojcieszak
Research Type: UHP Thesis

Infographics and Smoking Cessation among Adolescents Plan

Throughout the past couple of decades, there has been an increase in smoking of certain age groups. This can be caused by a variety of reasons, but the most impactful is peer pressure and societal norms. The age group that I am targeting ranges from 18-25-year-olds. According to the Centers for Disease Control and Prevention (CDC), 9 out of 10 adults that smoke regularly had their first cigarette around the age of 18, and 99% of those adults have tried a cigarette by the age of 26. The goal for my project is to create an infographic that informs populations and youth that smoking is not the norm and to avoid societal pressures with an ultimate objective of decreasing smoking intentions and increasing smoking cessation. Using the Theory of Planned Behavior and Theory of Reasoned Action, I have created several persuasive graphics that rely on theoretically driven appeals in order to prevent smoking behaviors or cease smoking among the target audience. The theories have taken into account various factors that will influence one to engage in a behavior, specifically smoking cessation and avoid smoking, for my project. I have focused my research prominently on two factors: subjective norms and perceived behavioral control. The infographics I have designed are modeled after these theories and factors. I will test the effectiveness of these persuasive appeals through Instagram and Twitter and review the reactions of the targeted audience.

| Joy Pedersen |

Major: History
Minor: Education
Mentor: Dr. Rachel St. John
Research Type: Honors Thesis in Major
**Campfires, Courtship, and Covered Wagons:
The Social and Cultural World of the Overland Trails**

Over 250,000 people traveled west on the Overland Trail during the mid-nineteenth century. This large number of emigrants moving westward in search of fortune and farmland meant more opportunities for interaction than previously available in the daily lives of Midwest farmers, especially for women. As overlanders rode in wagons westward, they carried their culture with them while embracing the freedom and flexibility offered by trail life. Building on the work of historians who have emphasized the distinct experiences of men and women and gendered divisions of labor on the Overland Trails, I examine the social life of overlanders to better understand how migration impacted their friendships and romantic relationships, as well as how they worshiped, celebrated, danced, and played. My research examines the emotional and relational nature of crossing the plains, the transmission of tradition and culture, as well as newfound freedom in the mobility of the trail. Based on analysis of women's overland trail diaries and memoirs spanning from 1840 to 1865, I demonstrate the importance of culture and connection in crossing the continent.

| Oh Nyuh Pak |

Major: Asian American Studies and English
Mentor: Dr. Richard Kim
Research Type: Honors Thesis in Major

We Are Dying to Be Heard: Examining News Coverage of Asian Americans During the COVID-19 Pandemic

"We are dying to be heard," cries activist Amanda Nguyen in a video highlighting another video where 84-year old Vicha Ratanapakdee is fatally pushed to the ground by a passing assailant. How do mainstream and ethnic news frame Asian Americans during the COVID-19 pandemic with increasingly reported anti-Asian hate crimes and George Floyd's death tied with the Black Lives Matter movement? How do Asian Americans themselves speak out in the news, resisting or even capitalizing on certain stereotypes? Using a historical and textual analysis, I examine several online news articles covering key events related to the Asian American community from the most credible mainstream news outlets, including NBC News, ABC News, and Fox News. I also compare these articles with those covering the same key events from Next Shark, an Asian American ethnic news outlet. I posit that the yellow peril and model minority stereotypes are framed in mainstream media as a counterscript in the wake of George Floyd's death and Thou Thau's role. I also look at the gendered representations of Kellie Chauvin and the Atlanta spa shootings. I further question the impact of Asian Americans as producers of news/media on the representation/visibility of issues, highlighting the controversial roles of specific celebrities/figures such as Daniel Dae Kim and Andrew Yang. I indicate the need for further research on news coverage of Asian Americans during the pandemic and the lived impact on the community.

| Bethany Ponte |

Major: Psychology
Mentor: Dr. Dave Furlow
Research Type: UHP Thesis
**Impact of Imposter Syndrome on
University Honors Transfer Students**

The importance of this research is to understand the impact that a University Honors Program (UHP) at an RI university has on transfer students and their perceptions of imposter syndrome. The hypothesis is that many students will be affected by imposter syndrome in the University Honors Program by having a fear of failure in the classroom and diminished involvement on campus. The Clance Imposter Scale survey, that included questions such as their perceptions on being successful or not belonging in their academics, was completed by a sample of 4th-year transfer students in the UHP program. The students with survey scores over 60, indicating the benchmark for imposter syndrome, were invited to an hour interview that discussed their process of being accepted to the UHP program and the ways that they became involved in their program. Data analysis indicates that the University Honors Program builds community, advising, and exposure to different opportunities and experiences, all which gives a similar support system to community colleges. Many found this program beneficial, however they did feel feelings of imposter syndrome within and outside of the program. Continued support by advisors and faculty can ensure that students are reaching their goals and feeling confident during their time in college.

| Daniel Ritchie |

Major: Computer Science

Minor: Education

Mentor: Dr. Darnel Degand

Research Type: UHP Thesis

Design and Development of a

Video Game to Teach Introductory Programming

Programming can be a difficult skill to learn for many undergraduate college students. However, learning to code can be extremely useful and beneficial to know for a number of fields, to aid with data analysis and visualization in those fields. Additionally, computational thinking is helpful for a better understanding of many of the technologies we use on a daily basis. In order to aid this learning, I chose a game as my medium because it has a high potential to motivate students and provide a good learning environment. I designed and began developing this video game to teach coding in the R programming language to non-computer science majors. While there are existing games that teach coding, I identified aspects in each that detract from their educational effectiveness. A majority have been made for a different audience than undergraduate college students, and have design choices that are profit-motivated instead of educationally motivated decisions. I then designed my game based on research-backed educational and game design principles which I identified and recorded in a literature review and evaluation of existing games. The game is expected to improve students' learning of introductory programming skills and principles, with an emphasis on data science concepts.

| Devapriya Roy |

Major: Political Science

Minor: Human Rights

Mentor: Dr. Keith David Watenpaugh

Research Type: UHP Thesis

Evaluating Cultural Destruction

Jurisprudence through Criminal Response, Restorative Response, and Regulatory Process Perspectives

Cultural heritage has a tenuous relationship with international humanitarian law. This thesis assesses the current state of international legal structures that exist to protect cultural heritage during armed conflict and formulates why cultural destruction should be treated as a consequential human rights issue. I lay out the role and theory of cultural destruction in key human rights legal concepts such as Crimes against Humanity and Genocide, and how these concepts are incomplete without including the destruction of cultural heritage. I use three approaches—the criminal response, the restorative response, and the regulatory process—to evaluate existing cultural destruction jurisprudence. In the criminal response section, I analyze the International Criminal Court's role in protecting cultural heritage. I utilize *The Prosecutor v. Ahmad Al Faqi Al Mahdi*, the first case in which the ICC imposed a sentence for attacking cultural heritage, and other cases undertaken by International War Crimes courts to conceptualize this approach. In the restorative response section, I explore post-Holocaust legal restitution efforts for looted cultural property, the restoration of built cultural heritage in the aftermath of destruction in cases such as Mali, and post-conflict efforts in countries like Syria to preserve cultural heritage. Finally, in the regulatory process section, I explore how cultural heritage can be conceptualized as matters of property law, repatriation, and nationally focused litigation and legislative efforts to protect cultural rights. Most significantly, I utilize the Native American Graves Protection and Repatriation Act as a case study to explore the protection of indigenous cultural property rights.

| Tatiana Roach |

Major: History

Minor: English

Mentor: Dr. Sudipta Sen

Research Type: UHP Thesis

British Rule Following the Seven Years War

The globally-spanning British Empire's ability to maintain its colonial holdings relied not on military might, but the populace's idea of masculinity. By looking at the man's expected paternal role in society, the ideal of owning property, corporal punishment in school, and the infantilization and effeminization of colonial subjects - specifically in India - we can see how ideas about a society's conception of gender roles have shaped history.

| Genevieve Ryan |

Major: Comparative Literature

Minor: Religious Studies

Mentor: Dr. Michael Subialka

Research Type: UHP Project

An Artistic Exploration of Women in Surrealism

Many male artists within the Surrealist movement objectified women. They presented women as sources for inspiration and desire yet without their own agency and subjectivity. Female bodies were often seen as muses, objects, or tools for the male artists' own artistic goals. I study this trend in Surrealism and research how female Surrealists either conformed to or subverted these sexist tendencies in the movement. In spite of the negative portrayals of women, many female Surrealists created artwork that gave agency to their female subjects. Responding to this research, I create my own collection of artwork and creative writing that approaches Surrealism from a female perspective. In addition, my artwork explores the Surrealist themes of perception, the body, and desire, as well as their relationship to gender and sexuality. The collection incorporates various Surrealist techniques such as automatic writing, collage, and exquisite corpse. Through creatively exploring the movement's themes and techniques in my own work, I contribute to a legacy of female Surrealists who critique the imbalance of gender within the movement and embrace female autonomy.

| Janelle Salanga |

Major: Science & Technology Studies

Mentor: Dr. Lindsay Poirier

Research Type: Honors Thesis in Major

Building Media for Revolution

The priorities of media and the way that communities of color have been covered have both long been dictated by white folks, resulting in the furthering of harmful stereotypes. Because access to institutions that lend credibility to community story-telling — namely, academia and media outlets — has been limited for communities of color, mainstream historical narratives and newspapers offer non-nuanced portrayals of Philippine-American issues. The barrage of images of Black death, immigrant detention, and government irresponsibility on social media engenders feelings of helplessness and hopelessness, rendering people unsure about actions they can take to fight against injustice in their communities. Consequently, this project — a series of workshops put together over the span of two quarters — will teach students about basic journalism frameworks and skills, in order to help folks become comfortable with talking to others in their community, understand the types of information (e.g. public records) available to them, and get used to doing independent research. It will provide space to build collective understanding around social structures and phenomena like racial capitalism and imperialism, while looking at the way those phenomena manifest in the Philippine diaspora and in the Philippines itself.

| Chloe Thepenier |

Major: Design

Mentor: Dr. Kathreen Fontecha

Research Type: Honors Thesis in Major

Dear Sister

Inspired by the analog information design Dear Data project by Giorgia Lupi and Stefanie Posavec, Dear Sister consists of an analog infographic exchange between a Graphic Design student in the United States and her sister, an Aerospace Engineer in France with a Master's Degree in Astrophysics. The main goal of the project is to explore ways to convey information related to space and space exploration efficiently in a restricted postcard format, through ten different topics. Personal reflections and processes are recorded through journaling and documenting. A more thorough analysis will include interviews of the postcard makers regarding the challenges they encountered and their takeaways, a visual analysis and comparison of the postcards, and interviews of several participants from the general public to evaluate the objective of clearly conveying information. A preliminary hypothesis based on the first two postcards suggests that while derived from the same data, the interpretation and prioritization of certain elements can differ depending on the maker, creating distinct narratives. Further analysis will assess the extent of these variations and the potential impact of personal bias and organization preference on information design layout and overall visual communication. A website will share the results with a wider audience.

| Alisha Singh |

Major: Political Science – Public Service and Science & Technology Studies

Mentor: Dr. Emily Merchant

Research Type: Honors Thesis in Major

Online Misinformation and Deception by Crisis Pregnancy Centers

Crisis Pregnancy Centers (CPCs) are privately owned clinics whose sole purpose is to dissuade women from obtaining abortions. CPCs advance their goal by providing medical advice that sounds legitimate, but is often false and intended to deceive women. The tactics used to advertise to women and get them to make a visit has changed since the inception of CPCs in the 1960s. CPCs have been known to use space in phone books, newspapers, and billboards to reach women. Amidst the surge of social media and online advertising, CPCs discovered new frontiers for spreading misinformation. This paper reviews literature on the use of websites, search engine optimization, and Google advertising by CPCs to target vulnerable women. It discusses the consequences of their actions and suggests possible remedies. Policymakers, researchers, and advocates need to be cognizant of the risks associated with the spread of misinformation around abortion as it may prevent women from making fully informed, autonomous decisions about their health.

| Mikka Vapor |

Major: International Relations and Economics

Minor: French

Mentor: Dr. Ga Young Chung

Research Type: UHP Thesis

Neo-Imperialism and the Cold War Legacy of the 21st Century: Analyzing the Triangular Relationship Between the United States, the Philippines, and China

This research examines the long-standing “special” relationship between the Philippines and the U.S. as it has developed and evolved from its colonial and imperial relations of the past. Despite the Philippines’ granted sovereignty, the U.S. still has close political, economic, and military ties with the Philippines, maintaining its large influence over the Philippines in its global economic and military presence. Focusing on the various international agreements including the Visiting Forces Agreement, the 2014 Enhanced Defense Cooperation Agreement, and other international policy proposals, I argue that the neo-imperialistic relationship of the U.S. and the Philippines has been maintained through their current international relations. I also address that the U.S. has attempted to draw the Philippines closer in their superpower rivalry with China, reflecting an ongoing Cold War legacy in the Asia-Pacific. By using a mixed methodology approach that includes Fairclough’s (1992) Critical Discourse Analysis, Cultural Political Economy Analysis, and Foreign Policy Analysis, I demonstrate that the language of these international agreements and policies reveals the U.S.’ perspective and view of their role in the Philippines, the U.S.-China rivalry and their discussed actions towards these countries.

| Preetha Vellayapan |

Major: Psychology
Minor: Education and Community Development
Mentor: Dr. Jacob Hibel
Research Type: UHP Thesis

Factors Influencing the Appeal of Ethno-racially Diverse Schools

While it is well known that race is a major determinant of school choice, it is not known to what degree student racial composition matters when compared to other school factors. Because the tendency of parents to choose schools with populations that are ethno-racially similar to them results in de facto school segregation, it is important to understand if certain school characteristics can mitigate these patterns. In order to understand how race and non-racial school characteristics interact to impact school choice preferences of California parents, a factorial survey will be administered. School characteristics such as racial composition, academic performance, class size, and the existence of magnet programs will be independently varied and presented to participants as vignettes to evaluate. Results will illustrate whether certain school characteristics motivate parents to choose schools with populations that are ethno-racially different from them. If there are school characteristics that significantly impact parent preferences despite racial dissimilarities, these findings can inform school policies to encourage California parents to choose more ethno-racially diverse schools.

| Victoria Vicuna |

Major: Philosophy
Minor: Spanish
Mentor: Dr. Tina Rulli
Research Type: Honors Thesis in Major

The Ethics of Animal Research and the Use of The Problem of Marginal Cases

The use of non-human animals in biomedical research has long been a contentious topic amongst scientists, philosophers, and animal rights' activists. With 25 million vertebrate animals used for research each year, the question regarding animals' possession of a moral status has been an ethical dilemma. Amongst the various arguments regarding the issue of animals' moral rights, the Problem of Marginal Cases (PoMC) has been used by many animal advocates. The PoMC is an argument used to compare the moral status of certain persons such as infants, the severely mentally handicapped, and the comatose, to non-human animals. The PoMC explains that if such persons, unfortunately referred to as "marginal", are given moral consideration, despite their inability to meet the usual criteria of a moral status, then non-human animals should also be given such consideration. This paper investigates the use of the PoMC and its validity in the ethical discussion of animal research. Whatever conclusion is decided on may lead to the consideration of changes in the ethical treatment of non-human animals. Moreover, such changes could lead to drastic adjustments in the use of animals in research, if not the complete elimination.

| Noah Yardeny |

Major: Pharmaceutical Chemistry
Mentor: Dr. David Olson
Research Type: Honors Thesis in Major

Investigating and Predicting Reactivity in the Azobenzene Forming Baeyer-Mills Reaction

Photopharmacology is an emerging synergistic field of chemistry and biology that harnesses the power of light to render chemicals active or inactive with high spatial and temporal control. Photoswitches are amendable groups to a pharmacophore which enable researchers to toggle compounds "on" or "off" rapidly and reversibly. Azobenzene photoswitches are synthesized through an N-N bond forming reaction between aryl nitroso and aryl amino compounds known as a Baeyer-Mill's Coupling. Three outcomes are common after a Mill's reaction: desired product is formed, starting material remains unreacted, or an undesired byproduct, azoxybenzene, forms lowering the azobenzene yield. Here, the electronic effects governing reaction outcome were explored in order to predict and attenuate substrates' ability to form desired azobenzene. To accomplish this, differently substituted anilines were tested for their efficacy as azobenzene producing substrates. Calculated oxidation potentials for these anilines were then used as a proxy for predicting reaction outcomes. These calculations were then performed on substituted indoles which showed low azobenzene yields. Following our predictions, the electron-rich indoles' yields immensely improved through employment of labile protecting groups. Overall, these results demonstrate that substrates can be electronically manipulated to increase azobenzene yields and offers synthetic tools for researchers interested in studying photoswitchable compounds.

| Melanie Yoon |

Major: Psychology and Linguistics
Mentor: Dr. Katharine Graf Estes
Research Type: Honors Thesis in Major

The Role of Infant-Directed Action on Infant Attention

Caregivers modify their actions when demonstrating objects to infants, known as infant-directed action (IDA). This study explores whether infants look longer at caregivers' mobile gestures (with movement of the hand or arm) or stable gestures (without movement). I investigate if there are differences in infant looking time for gestures with small motions compared to large motions and whether monolingual and bilingual caregivers differ in frequency of gesture change. As most IDA research has been conducted in laboratory settings with manipulated gestures, I aim to examine naturalistic IDA through observing play sessions. 38 infant-caregiver pairs (19 monolinguals, 19 bilinguals) engaged in two tasks: free play and object-labelling. Interactions were recorded and coded for showing gestures, infant eye gaze, and caregiver language. I predict that (i) showing gestures with larger movements will be more effective at attracting and sustaining infant attention and, (ii) bilingual dyads will use gestures specific to bilingual input - they will switch or exaggerate gestures around a language change. Therefore, bilingual caregivers may show a higher frequency of gesture change and high amplitude gestures compared to monolingual caregivers, leading to longer looking times for bilingual infants. This research will aid in understanding the role of gestures on infant learning.