2019
2020

GRADUATE RESEARCH BOOKLET

UCDAVIS
University Honors Program
Office of Undergraduate Education

Letter from the Director

Dear friends,

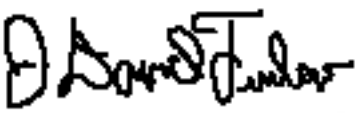
It is my pleasure to introduce and congratulate this year's impressive group of University Honors Program (UHP) students who have completed their signature capstone theses and independent projects. The work represented here reflects the culmination of hard work and creative and critical thought that 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 to... well, 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

Index of Participants

College of Agricultural and Environmental Sciences

Alyssa Allen
Nutrition Science
Montserrat Armero
Animal Science
Antonia Bartz
Human Development
Savannah Boyd
Nutrition Science
Nicole Carr
Animal Biology
Danielle Fradet
Wildlife, Fish and Conservation Biology
Yael (Izzie) Hack
Animal Biology
Logan Hamilton
Wildlife, Fish and Conservation Biology
Fiona Kilby
Animal Science
Michelle Mah
Wildlife, Fish and Conservation Biology
Estefania Maravillas
Wildlife, Fish and Conservation Biology
Ana-Begona Molina Gil
Animal Science
Lucero Morales
Biotechnology
Mary Morgan
Clinical Nutrition
Brianna Pinto
Wildlife, Fish and Conservation Biology
Trina Reynolds
Biotechnology
Rebecca Shaffer
Animal Science
Alexxa Varela
Animal Science
Maaike Wielenga
Environmental Science and Management
Michael Yoakam
Environmental Policy Analysis and Planning
Xingyue Zhang
Environmental Science and Management

College of Biological Sciences

Dana Butler
Neurobiology, Physiology and Behavior
Julia Marie Castro
Genetics and Genomics
Marcus Cohen
Evolution, Ecology and Biodiversity & History
An Dang
Neurobiology, Physiology and Behavior
Nhu Dang
Neurobiology, Physiology and Behavior
Paris Dhillon
Biochemistry and Molecular Biology
Journie Dickerson
Neurobiology, Physiology and Behavior
Jillian Dyer
Evolution, Ecology and Biodiversity
Matilda Fritz
Biological Sciences
Sarah Goldberg
Biochemistry and Molecular Biology
Iris Juanico
Biochemistry and Molecular Biology
Camilla Mancuso
Neurobiology, Physiology and Behavior
Analisa Milkey
Biological Sciences
Marjan Moghaddam
Neurobiology, Physiology and Behavior
Catherine Nugent
Biochemistry and Molecular Biology
Sharon Pala
Neurobiology, Physiology and Behavior
Abigail Pfefferlen
Biological Sciences
Annabelle Rankin
Biological Sciences & English
Mahssa Rezaei
Cell Biology
Paola Rodriguez
Neurobiology, Physiology and Behavior
Jose Sandoval
Neurobiology, Physiology and Behavior

Tara Shahrvini
Neurobiology, Physiology and Behavior & Spanish
Michael Stickels
Biological Sciences
Kathryn Strock
Neurobiology, Physiology and Behavior
Laiba Tauseef
Biological Sciences
Andy Yan
Neurobiology, Physiology and Behavior
Felicia Yen
Cell Biology

College of Letters and Science

Belen Alcantar
Sociology & Chicana/Chicano Studies
Alexa Alcser
Psychology
Katelyn Banh
Managerial Economics
Gina Casaccia
Psychology
Sophia Chen
Statistics & Economics
Grant Cottier
Music & Chemistry
Sanjna Duvvur
Computer Science
Luis El Srouji
Applied Physics
Uriel Matthew Enriquez
Pharmaceutical Chemistry
Jumana Esau
English
Kenton Goldsby
Religious Studies & Spanish
Ronald Guerra
Computer Science
Jameson Hammond
Political Science & Economics
Elias Heffan
Computer Science
Stephanie Jennings
Political Science – Public Service
& Gender, Sexuality, and Women's Studies
Isabella Johnson
Anthropology
Ryan Jung
Chemistry
Aravind Krishnachandran
Statistics
Hang Shan (Agnes) Lam
Design
Frances Jing Lansdowne
Psychology
Samuel Little
Chemistry
Melissa Loomis
Cognitive Science
Nicole Matsuda
Sociology & Communications
Joshua Melton
Economics
Esmeralda Mendoza
Political Science
Kaelan Mikowicz
Computer Science
Michael Montgomery
Marine and Coastal Science—Oceans
and the Earth System
Thuy Vi Thi (Vi) Nguyen
International Relations
Kelly Nishimura
Landscape Architecture
Stephanie Quero
Political Science – Public Service & Chicana/Chicano
Studies
Kausalya Raman
Design & Economics
Megan Reeve
English & Philosophy
Dorothy Riley
Psychology
Ivan Rocha
Psychology & Chicana/Chicano Studies
Caroline Rutten
Sociology
Marina Schroder Bydalek
Linguistics

Index of Participants

Jeffrey Seidl
International Relations
Matthew Self
Physics & Mathematics
Nikita Shetty
Psychology
Jagveer Singh
Computer Science
Nathan Soland
Chemistry
Eric Thai
Political Science
Emma Tribble
Chemistry
Jency Umana Linares
Psychology & Chicana/Chicano Studies
Julie Xu
Design & Economics
Emma Zamora
Chicana/Chicano Studies
Susanna Zheng
Psychology

Engineering

Andrei Blebea
Computer Science and Engineering
Aidan Callahan
Electrical Engineering
Kay Hadrick
Biomedical Engineering
Navjot Kaur
Electrical Engineering
Emma Kristovich
Computer Science and Engineering
Noah Larson
Civil Engineering
Chandni Nagda
Computer Science and Engineering
Nancy Ng
Chemical Engineering
Shaye Spani
Biomedical Engineering
Aya Suzuki
Biological Systems Engineering
Rachel Talbot
Chemical Engineering
Allison Tearjen
Chemical Engineering
Derek Wadsworth
Chemical Engineering

College of Agricultural and Environmental Sciences

Alyssa Allen

Major: Nutrition Science

Mentor: Rachel Scherr

Research Type: UHP Capstone Project

Nutrition Education for University Student Triathletes May Improve Nutrition Knowledge

While the UC Davis Triathlon Team has comprehensive information about the physical aspects of training, there is minimal information regarding nutrition. This nutrition education program aims to increase the nutrition knowledge of the athletes on the team. Based on a review of the literature, a presentation and a brochure deliverable encompassing a range of sports nutrition information was created and presented, covering topics such as how to ensure adequate nutrition for workouts and races. Analysis of the responses generated from a standardized questionnaire was completed to understand the amount of information gained by participants. The results indicated that the presentation yielded increased nutrition knowledge in UC Davis Triathlon student-athletes. Based on these results, this type of program could be implemented for other club sports teams both within or outside of UC Davis to increase nutrition knowledge. Further research is needed to identify other factors that could strengthen the effectiveness of the program.

Montserrat Armero

Major: Animal Science

Mentor: Lorena Garcia

Research Type: UHP Capstone Project

Educating Future Veterinarians and Health Care Providers on How to Overcome Language Barriers

As the U.S. becomes more diverse, the number of pet owners and health care patients with limited English proficiency (LEP) is increasing. Overwhelming research has shown that language barriers (LB) contribute to health disparities. Policies have been put in place to provide language access (LA) services in health care, but these requirements are not always met. Minimal research has been done to show the impact of LB and how to overcome them in veterinary care, even though communication is essential to care. The purpose of this project was to provide an LB educational intervention to pre-vet/health undergraduate volunteers in the Knights Landing One Health Center (KLOHC). The KLOHC is a no-cost clinic that offers both medical and veterinary care to the town of Knights Landing, and provides these services largely to Spanish speaking, rural underserved farmworkers. The LB education intervention included didactic lecture and discussion activities. To assess the effectiveness of the LB educational intervention the knowledge assessment questionnaire and course feedback was administered before and after the program.

Antonia Bartz

Major: Human Development

Mentor: Jennifer Falbe

Research Type: UHP Capstone Thesis

A Comparison of the Prevalence of Pouring Rights Contracts Between American and Global Universities

Many US universities appear to have pouring rights contracts with sugar-sweetened beverage (SSB) companies. In exchange for paying a university sponsorship money, these contracts give SSB companies the rights to advertise and make their products available on campus. However, SSBs increase risk for chronic disease, and young people consume high amounts of SSBs. Although pouring rights could pose a barrier to public health, there has been no empirical research on their prevalence. The objective of this study was to investigate the prevalence of SSB pouring rights contracts at the top US and international public and private universities. US News Best Global University Rankings were used to identify the top 100 US universities and top 100 non-US universities. These universities were then contacted about pouring rights contracts, and based on their responses, were classified as having or not having SSB contracts. Preliminary findings suggest that pouring rights are markedly more common in the US (about 96%) than abroad (about 10%), but data collection is still ongoing. There appear to be large cultural differences in the approach to beverage contracts between universities in the US and abroad.

Savannah Boyd

Major: Nutrition Science

Mentor: Jennifer Smilowitz

Research Type: UHP Capstone Thesis

Relationships Between Infant Fecal pH and Growth of Breastfed Rwandan Infants

Growth failure, or stunting, is the most common manifestation of malnutrition globally and is estimated to affect about 160 million children each year. It is particularly pervasive in low- and middle-income countries where food availability and certain measures of sanitation are strikingly low. A historically underrecognized player in this process is the gut microbiota, including its microbial inhabitants and metabolic functions. Over the past decade and more specifically these past few years, researchers have been delving into the details of this mysterious microbial habitat to understand which of its characteristics are intimately involved in human processes and how. Specifically, my project will be focusing on the relationship between infant fecal pH and anthropometric growth outcomes in breastfed infants in a small community in Rwanda. I will be analyzing the relationship between the infants' fecal pH and the prevalence of stunting, wasting, and underweight using statistical analysis software. I hypothesize that a higher fecal pH will be positively correlated with the following negative growth outcomes: stunting (height-for-age z-score <-2 standard deviations below the World Health Organization (WHO) growth standards median), wasting (weight-for-height z-scores <-2 SD below the WHO median), and underweight (weight-for-age z-scores <-2 SD below the WHO median).

| Nicole Carr |

Major: Animal Biology
Mentor: Boaz Arzi
Research Type: Honors Thesis in Major

Cone-Beam Computed Tomography and Canine Temporomandibular Joint Osteoarthritis: An Agreement Study

Temporomandibular joint (TMJ or “jaw joint”) disorders are common in people, affecting an estimated 12% of the population. Recent research indicates that TMJ disorders are also common in animals and that arthritis is the most common disorder of dog TMJs. Cone-beam computed tomography (CT scan) is a valuable diagnostic tool used in veterinary and human medicine to visualize osseous structures. This study aimed to correlate CBCT findings of naturally occurring TMJ disorders with characterization via gross and histopathologic evaluations. TMJs (n=38) were evaluated using CBCT for amount of periarticular new bone formation, subchondral bone sclerosis, joint space narrowing, and subchondral/cortical bone changes. Radiographically, 34 mandibular heads and 36 mandibular fossas had sclerotic changes, and 31 TMJs had some degree of joint space narrowing, thus indicating that subchondral bone sclerosis and joint space narrowing were the most common radiographic findings. Upon gross evaluation, majority of specimens (39%), had between 10-25% surface area affected by cartilage defects. Histologically, changes included fibrillations, areas of cell death, articular cartilage loss, subchondral bone exposure, and subchondral bone sclerosis. It is expected that statistical analysis results will show a correlation between amount of degenerative joint changes noted in the CBCT scans and gross and microscopic evaluations.

| Danielle Fradet |

Major: Wildlife, Fish and Conservation Biology
Mentor: John Eadie
Research Type: UHP Capstone Thesis

Distinguishing the Effect of Microhabitat Variation on the Occupancy of Breeding Birds in Glenn County, California Using Automated Recording Units

"Landscape level avian occupancy modeling has recently been at the forefront of avian biodiversity studies in California’s Central Valley. A 2018 study uses automated recorder units (ARU) to gather bird data across the Valley landscape. ARUs can be used to saturate a large landscape with time dependent surveys of birds; thus gathering more data on bird presence than traditional point counts. The results from the Central Valley study provide avian habitat occupancy models based on vegetation cover classes and predicts avian diversity based on habitat heterogeneity. My study will test ARU method at a microsite and compare site-specific results to those predicted from the landscape-level study. To test microsite occupancy of breeding birds, 360, 5-minute recordings were taken in spring and summer of 2019 at Bird Haven Ranch (BHR) in Glenn County. BHR is a heterogeneous habitat of rice, wetlands, and riparian systems. Recordings were balanced so effort was standardized between the three main habitat types. Interpretation of avian recordings will allow me to construct a detection history for use in occupancy estimation on BHR, and compare results to predicted occupancy models for the Sacramento Valley. If found predictive, ARU method might be more broadly applied for site-specific diversity studies.

| Izzie Hack |

Major: Animal Biology
Mentor: Rebecca Bellone
Research Type: Honors Thesis in Major

Whole Genome Sequencing Identifies Missense Mutation in GRM6 as the Likely Cause of Congenital Stationary Night Blindness in a Tennessee Walking Horse

Congenital stationary night blindness (CSNB) is an inherited, non-progressive retinal disorder characterized by absence of vision under low-light conditions. Currently, the only known genetic cause of CSNB in horses is an insertion in TRPM1. However, one Tennessee Walking Horse diagnosed with CSNB did not have this mutation. To identify a causal variant, whole genome sequence data from this case was compared to data from horses from seven other breeds (n=29). One hundred candidate genes were assessed for coding variants. Variants homozygous in the case and absent in all other horses were prioritized for further investigation. A single missense mutation in metabotropic glutamate receptor 6 (GRM6 c.533C>T p.Thr178Met), a gene known to cause CSNB in humans, was identified. This SNP was predicted to be deleterious by the consensus classifier PredictSNP. Thr178 is conserved across vertebrate species and is directly involved in binding glutamate, and is thus essential to on-bipolar cell signaling that enables vision in low light conditions. Methionine at position 178 is hypothesized to impair glutamate binding, which was supported by protein modeling. In screening 90 unrelated Tennessee Walking Horses, the estimated allele frequency was 10%. These data provide evidence that this SNP is causal for CSNB in this breed.

| Logan Hamilton |

Major: Wildlife, Fish and Conservation Biology
Mentor: Dirk Van Vuren
Research Type: UHP Capstone Project

Activity budget and enrichment for two-toed sloth Choloepus didactylus

Enrichment is a central aspect of modern zoo philosophy, with animal care teams employing devices such as toys, novel foods, and forage piles to stimulate intellectual processes and encourage natural animal behaviors. I analyzed the effectiveness of an olfactory enrichment on a single two-toed sloth Choloepus didactylus at the Sacramento Zoo, comparing activity budgets between a baseline “control” period and an enrichment-applied “experimental” period. There was an observed increase in the time spent resting along with decreases in time spent eating and time spent engaging with enrichment items. There was also an observable decline in time spent in the exhibit portion furthest from the indoor den space coupled with increases in time spent closer to and within the den. These results suggest that olfactory enrichment is not an effective long-term solution for encouraging greater sloth activity in a zoo setting. However, it may have a role in infrequent, short-term enrichment programs, and further studies should assess this potential over larger samples.

| Fiona Kilby |

Major: Animal Science
Mentor: Leslie Woods
Research Type: Honors Thesis in Major

Pneumoconiosis in Island Foxes (Urocyon littoralis)

Island foxes (Urocyon littoralis) are located on six of the eight-island archipelago of the Channel Islands, each with its own subspecies. Once on the brink of extinction, a highly coordinated captive breeding program and ecosystem restoration project resulted in the fastest recovery of an endangered mammal in United States history. The purpose of this project is to determine if island foxes on San Clemente Island are contracting pneumoconiosis at a higher rate of frequency and severity than the other subspecies. Preliminary data supports the hypothesis that pneumoconiosis presents itself in a disproportionate manner on San Clemente Island. This is being researched through literature review, necropsy case files, and histopathological scoring. At the conclusion of this study, a scale of the severity of pneumoconiosis will be complete. If possible, a map of the GPS locations where the fox carcasses were found will also be created. This research explores how pneumoconiosis affects air exchange within the lung. Research on pneumoconiosis in the island fox may shed light on potential health risks for humans exposed to the same environment. To the authors' knowledge, this is the first paper addressing pneumoconiosis in foxes.

| Michelle Mah |

Major: Wildlife, Fish and Conservation Biology
Mentor: Lisa Tell
Research Type: UHP Capstone Project

Taqman Quantitative Real-Time PCR for Detecting Avipoxvirus DNA in Various Sample Types from Hummingbirds

Avian pox (genus Avipoxvirus, family Poxviridae) is a virus spread by arthropod vectors or mucosal membrane contact with infectious particles. A hummingbird infected with pox virus can develop wart-like lesions on non-feathered areas of the body, which may negatively impact the birds' biological fitness. Although pox viral infections are widespread and fairly common in many bird species, little is known about the factors that might make hummingbirds susceptible to this virus. This study investigates the prevalence of avian pox viral infections in Anna's Hummingbird (Calypte anna) carcasses from California wildlife rehabilitation centers. Using real time polymerase chain reaction (PCR) testing of tail feather and toenail samples taken from carcasses, the disease prevalence was estimated. A scoring system was established for visual rating of lesion severity and spread for each carcass, and the scores were compared to the PCR viral load results for tail feather samples. Regression analysis was used to compare the positive/negative viral status to covariates such as age, sex, season (time of year at death), and geographic region (Northern or Southern California). This study will help to bridge data gaps in the ecology and epidemiology of avian pox in hummingbirds.

| Estefania Maravillas |

Major: Wildlife, Fish and Conservation Biology
Mentor: Andrew Engilis, Jr. and John Eadie
Research Type: UHP Capstone Thesis

Documenting First Year Use of Nest Boxes and Abundance of Secondary Cavity-Nesting Birds at Bird Haven Ranch, Glenn County, California

In Fall 2018, The UC Davis Museum of Wildlife Fish Biology (MWFB), established a songbird nestbox highway (31 boxes) on Bird Haven Ranch (BHR), Glenn County, California. The objective of this study was to monitor use of boxes on BHR and compare the diversity, productivity and abundance to that of Putah Creek, where MWFB scientists undertake similar surveys. The study involved monitoring bird use of boxes throughout the 2019 breeding season. Weekly visits were conducted from April – June 2019. By monitoring clutches, nestling growth, and banding nestlings, we were able to track box use, nestling growth, and fledgling success. In 2019, 39 clutches were initiated in 30 boxes at BHR. House Wrens accounted for 90% of the broods. On Putah Creek, Tree Swallows were the primary species (57%). Fledgling success at BHR was 88%, greater than that measured on Putah Creek (73%). We will compare results of the 2019 BHR boxes with those of the initiation year on Putah Creek (1999) to determine if species composition is similar in the first year of both projects.

| Ana-Begona Molina Gil |

Major: Animal Science
Mentor: Rebecca M. Calisi
Research Type: Honors Thesis in Major

Is defensive aggression heritable in rock doves?

Defending a nest often requires the use of aggression to fend off invaders. Most studies on aggression have focused on courtship and territorial behaviors driven by testosterone, which is largely produced in sexually mature testes. However, we have observed aggression in the context of nest defense in both male and female parents, as well as offspring, suggesting control of this behavior may stem from different biological pathways. Little is known about how physiological mechanisms mediating defensive aggression vary in individuals, and if this is heritable. To investigate, we have been quantifying aggression observed in a rock pigeon (Columba livia) colony and assessing the repeatability of defensive behaviors within individuals over the breeding period. Our intention is to use these data to evaluate whether there is a relationship between the aggression exhibited by an individual and that exhibited by other individuals in its lineage. As studies have found a genetic basis for aggression in chickens, we predict we will discover a heritable component to defensive aggression in pigeons. Overall, understanding the genetic basis of defensive aggression may increase our understanding of the heritability of behaviors.

Lucero Morales

Major: Biotechnology
Mentor: John Yoder
Research Type: Honors Thesis in Major

Optimization of Agrobacterium-Mediated Strawberry Transformation Method

Strawberry is an economically important crop whose production scale heavily depends on many factors. Traditional breeding methods for improving traits to combat fruit losses are difficult and time consuming; therefore, genetic transformation methods are possible for introducing beneficial genes to improve yield. Previous research established successful protocols using antibiotic selection agents; however, there are limited publications and they contain long regeneration times. Transformation protocols using different plant selectable marker genes allows pyramiding of advantageous traits because a desired trait can be introduced using one selectable marker; then the transgenic line can be re-transformed with another trait using a second selectable marker. To test the efficiency of two selectable markers, three Agrobacterium-mediated transformation protocols were used. For each protocol, the cultivar Camarosa underwent transformation with three constructs. One contained the DELLA-BZR1 gene and the 35s:hpt selectable marker conferring resistance to the antibiotic hygromycin. Another contained the DELLA-PIN1 gene and the nos:nptii selectable marker conferring resistance to the antibiotic kanamycin. The control contained the fluorescent marker gene DsRed and the nos:nptii selectable marker. Developing efficient transformation protocols, while also optimizing for multiple selection agents is critical in improving research and finding commercially important traits on a quicker time scale.

Mary Morgan

Major: Clinical Nutrition
Mentor: Rachel Scherr
Research Type: UHP Capstone Thesis

Determining Motivators of Food Choice in the UC Davis Student Population

To determine motivators of food choice in the UC Davis student population, a questionnaire centered on nutrition support strategies was developed by a panel of survey design experts and underwent cognitive interviewing to improve question clarity. The final questionnaire was distributed during Winter Quarter 2020 to a random sample of 10,000 students using a modified tailored design method. The survey response rate was 14.03% (n = 1403). With respect to food choice motivators, the primary motivators were cost (67.64%), nutritional value (61.51%), convenience (54.81%), taste (46.97%), familiarity (40.41%), meal planning (34.71%), appearance (34.28%), and dietary restrictions (25.87%). In order to understand what may predict these particular motivators, regression and Chi-square analyses were conducted to determine which factors were most correlated with food security status, academic status, as well as student demographics. The goal of this study is to help future projects develop targeted interventions such as optimizing value for nutritious foods to overcome any perceived barriers to food access and influence food choice motivations in the UC Davis student population.

Brianna Pinto

Major: Wildlife, Fish and Conservation Biology
Mentor: Karen Bales
Research Type: UHP Capstone Thesis

Behavioral and Physiological Effects of Housing Density on Pair Bonding Primates

Primates live in a variety of social groupings and vary in the expression of species-typical behaviors depending upon social conditions. Coppery titi monkeys (Plecturocebus cupreus) are pair bonding, territorial primates used to study social behavior. In captivity, close proximity between these territorial monkeys may result in density-induced stress responses. We measured behavioral and physiological variables related to pair bonding in 27 pairs of titi monkeys and predicted higher density housing would reduce affiliation within pairs, but increase urinary glucose, compared to lower density housing. Affiliative behavior was recorded via bihourly scan sample. Urinary glucose values were evaluated using urinalysis strips. As predicted, we found that titi monkey pairs were significantly more affiliative in lower compared to higher density housing during their first month ($p=0.0004$) and last month in each location ($p=0.008$). Urinary glucose values differed based on housing density ($p=0.03$) in a direction opposite to our prediction, but this result may be due to confounding factors unrelated to density. The results of this study suggest that titi monkey pair behavior is influenced by the number of conspecifics present, and management decisions should reflect the implications of these stress responses on the results of social studies.

Trina Reynolds

Major: Biotechnology
Mentor: John Yoder
Research Type: Type: Honors Thesis in Major

Assessment of Growth-Stage-Dependent Sprays of MBI-505 on Rice (Oryza sativa)

MBI-505 is a product developed and sold by Marrone Bio Innovations. It is currently sold on the market as a plant stress reductant. In particular, it is known to protect plants from UV rays in sunlight. However, further experiments have produced data that suggests that MBI-505 is doing more in the plant than originally expected. An experiment on wheat conducted by the company found that applications of MBI-505 increased grain weight, root growth, and yields. However, the effects of MBI-505 appear to be growth-stage dependent. In order to investigate this observation further, Oryza sativa (rice) plants were sprayed with MBI-505 at one of four growth stages: early vegetative, late vegetative, flower initiation, or senescence. After senescence, the plants were harvested. Spike, grain, root ball, and vegetative biomasses were determined. Then, harvest indices were calculated for each treatment and the root systems were analyzed using WinFolia software. This information will increase the effectiveness of MBI-505 application and use by farmers. The company can now advise farmers which growth stage to spray at in order to maximize the positive effect on yield.

Rebecca Shaffer

Major: Animal Science
Mentor: Kristina Horback
Research Type: UHP Capstone Thesis

Evaluating Depth Perception in Laying Hens

Legislation in California has mandated that eggs sold in the state must come from laying hens housed in cage-free environments. While this change provides more space per bird and greater opportunities to perform species-specific behaviors, recent reports suggest that this housing system may result in an increased propensity of keel-bone injuries. Given that difficulty in navigating a 3-D space appears to be one source of these injuries, this study will investigate how variation in perceived platform height may impact hen behavior. Twenty-three commercial breed hens were placed in a visual cliff experiment that had a movable platform, allowing for the illusion of a cliff at 4, 8, and 12 inches deep, as well as a control of no depth (0 inches). Each hen was placed on the solid side of the visual cliff table while dried mealworms were placed on the cliff side to incentivize the movements of the hens. Various behaviors were recorded, including time spent looking over the cliff's edge and latency to cross cliff. The hypothesis of this study is that all hens will demonstrate a longer latency to cross the cliff, or not cross at all, as the perceived depth increases.

Alexxa Varela

Major: Animal Science
Mentor: Ed Depeters
Research Type: UHP Capstone Thesis

In Vitro Analysis of an Alfalfa Variety Genetically Edited for Reduced Lignin

Lignin, a major structural component in plant cell walls decreases the digestibility of fiber (cellulose and hemicellulose) by ruminants. Reducing digestibility of fiber has a negative effect on livestock production efficiency because the animal obtains less energy from the consumed feed. This research project compares the digestibility of fiber in two varieties of alfalfa, a conventional variety (not genetically modified) and a genetically edited variety for reduced lignin synthesis. These alfalfa varieties were also harvested at two different physiological maturities. The approach to evaluate digestibility uses the following in vitro rumen fermentation methods: (1) gas production syringe system, (2) ANKOM RF Gas Production system, and (3) ANKOM Daisy system. All samples are run in triplicate over three independent runs. Gas methods will provide estimates of rate and extent of fermentation. The Daisy method will measure dry matter and neutral detergent fiber degradation. With the research still in progress, initial findings show that reduced lignin alfalfa at both maturities was higher in digestibility and had a greater amount of gas produced. The goal from this study is to improve our understanding of how lignin impacts the ability of rumen microorganisms to ferment fiber and provide energy to the ruminant productive purposes.

Maaike Wielenga

Major: Environmental Science and Management
Mentor: Clare Cannon
Research Type: Honors Thesis in Major

Tracing Plastic Recycling at UC Davis

People assume plastics thrown in recycling bins get recycled, but recent news about the global plastic waste trade has put that assumption into question. Are we being mislead about our environmental impact? Plastics that are not recycled contaminate our environment through incineration, landfilling, or pollution, causing adverse health effects for humans and other organisms. UC Davis is an important study site to further our understanding of plastic waste disposal, as an academic community with a population of approximately 63,000 and an institution of higher education committed to sustainability and zero waste. To this end, my research investigates what happens to plastic waste thrown in recycling bins at UC Davis. Preliminary research indicates that mixed waste recycling and the complexity of interlocking systems of global waste streams make tracking waste from UC Davis difficult. In order to answer this challenging question, I will interview institutional administrative officials and plastic waste industry professionals to trace plastic recycling waste flows from UC Davis. Implications of this research are further discussed. This research will be made available to the UC Davis community through a website and to UC Davis decision makers to inform UC Davis recycling policy through a policy brief.

Michael Yoakam

Major: Environmental Policy Analysis and Planning
Mentor: Susan Handy
Research Type: Type: Honors Thesis in Major

Achieving California's Climate Goals: A Comparison Between California Policy Options and Swedish Greenhouse Gas Emissions Reduction Policy

Under SB 32, California seeks to reduce its greenhouse gas emissions to 40% below the 1990 levels by 2030. It is clear that California will need to implement further emissions reduction policies to reach this ambitious goal. My research seeks to study both how California has reduced its greenhouse gas emissions thus far as well as the overlap and differences between what policies academics indicate will be successful in California and what policies have historically been successful in Sweden. This paper will compare emissions-reduction policies between different influential sectors such as transportation, agriculture, electrical generation, etc., as well as between different levels of government. By undertaking a narrative review of notable emissions-reduction research and comparing that research to practices abroad, my research will shed some light on both the cultural and institutional differences that influence emissions-reduction policy as well as what tried-and-true methods California might consider employing to reach its climate goals.

| Xingyue Zhang |

Major: Environmental Science and Management

Research Type: Honors Thesis in Major

College of Biological Sciences

| Dana Butler |

Major: Neurobiology, Physiology and Behavior
Mentor: Nicole Sparapani
Research Type: UHP Capstone Project

Investigating Whether Implementation of MTSS and UDL Correlate to Teachers' Knowledge, Attitudes, and Confidence when Teaching Students with Autism in Mainstream Classrooms

Autism is a neurodevelopmental disorder that may hinder an individual's ability to communicate and interact with others due to a lack of joint attention (Centers for Disease Control and Prevention, 2019; Mundy & Crowson, 1997). In addition, individuals with autism may experience fixated interests and repetitive, stereotyped behaviors (CDC, 2019). As an effort to place students with disabilities in the least restrictive environment, 90.8% of the students with autism are spending at least some portion of their school day in general education classrooms (U.S. Department of Education, 2018). While an inclusive classroom may provide students with autism an opportunity to build relationships with other students and participate in school-wide environments, teachers report feelings of lower self-efficacy and higher burnout when teaching students with autism, resulting in higher teacher turnover and lower student academic success (Bojut et al., 2017). With the rise in teachers feeling underprepared when teaching in an inclusive classroom, new strategies like Multi-Tiered System of Support (MTSS) and Universal Design for Learning (UDL) are being implemented in the curricula of credential programs to promote differentiated learning for all students. In the current study, 30 K-12 preservice teachers, who were concurrently enrolled in the UC Davis teacher credential program, completed a survey on their attitudes towards students with autism, their application of the MTSS and UDL standards, and their confidence in instructing an inclusive classroom. According to the survey responses, teachers who utilize the MTSS and UDL frameworks in their inclusive classrooms tend to have more positive attitudes and greater confidence when working with students with autism. In addition, teachers who reported positive attitudes towards students with autism also disclosed greater confidence when applying the MTSS and UDL standards.

| Marcus Cohen |

Major: Evolution, Ecology and Biodiversity & History
Mentor: Jonathan Eisen
Research Type: Honors Thesis in Major

Looking for Anammox in All the Wrong Places? A Search for Novel Anammox Taxa in Wastewater Metagenomic Data

Anammox, or anaerobic ammonium oxidation, is a metabolic pathway in which bacteria convert nitrite and ammonium to nitrogen gas. It is both instrumental in the natural nitrogen cycle and a possible method of human wastewater treatment. To date, all known bacteria capable of carrying out anammox reside within the phylum Planctomycetes. Following up on preliminary results from earlier projects, I am investigating the possibility finding of novel, non-Planctomycetes anammox-capable genomes within wastewater metagenomic datasets. This work began by focusing the genetic structure of the anammox pathway to understand which genes are essential to the process. Currently, I am using existing metagenomic datasets from wastewater in which our lab previously identified metagenomic "bins" containing anammox genes to determine if these non-Planctomycetes, anammox bins are valid. All currently known species that carry out anammox are slow-growing and highly susceptible to environmental stressors like oxygen, making their utilization in wastewater treatment difficult; the discovery of novel anammox taxa may help make the scaling and industrial use of anammox more efficient.

| Julia Marie Castro |

Major: Genetics and Genomics
Mentor: Genetics and Genomics
Research Type: Bryan Enderle

Foundations: Helping College Freshman Thrive Through Mentorship

Forming significant relationships, identifying and growing in areas of personal weakness, and developing personal values are all important parts of one's college experience. Many students experience significant difficulty as they learn how to develop these skills, especially in their first year at a university. I am studying how to help students in the Navigators at UC Davis, a faith-based club, be successful in these aspects of their undergraduate experience by implementing a 6-week program for college freshmen. A preliminary survey suggests that these first year students struggle to create meaningful friendships outside of facilitated groups and to take practical steps to live out self-identified personal values. In order to address these difficulties, small groups of freshmen met weekly with seniors to learn about older students' experiences and discuss common values. In these meetings, an additional expectation to practice goal-setting and to initiate interactions with peers of all ages was set for participants. The aim of this study is to analyze the importance of mentorship relationships and peer accountability in helping younger students in this club develop the skills needed to succeed in college.

| An Dang |

Major: Neurobiology, Physiology and Behavior
Mentor: Ian Brown
Research Type: Honors Thesis in Major

Characterization and Evaluation of Vascular Injury in a Porcine Ischemia-Reperfusion Injury Model

Ischemia–reperfusion injury occurs when perfusion is restored to the tissue after a period of ischemic events. Despite the benefit of preventing tissue necrosis, reperfusion can trigger additional tissue injury through inflammation and thrombosis. In our study, the porcine model relevant to resuscitative endovascular balloon occlusion of the aorta (REBOA), a hemorrhage-control technique involving occlusion of the aorta that can induce reperfusion injury. The goal of this project was to identify vascular injury and characterize its features to develop a consistent histopathological scoring system. To localize injury in the vasculature, paraffin-embedded abdominal-aorta tissue sections from treatment group and sham pigs were stained with the immunofluorescent intercellular adhesion molecule, ICAM-1, and the immunofluorescent fibrin. Immunofluorescent staining with ICAM-1 demonstrated the presence of proinflammatory effects such as potential inflammatory leukocyte recruitment. The quantification of immunofluorescent fibrin accumulation allows us to deduce the likelihood of thrombotic formation. Our histopathological scoring system is based on typical vascular injury features such as increased expression of endothelial cell adhesion molecules and increased expression of thrombosis-inducing fibrin. This scoring system will allow us to identify vascular injury and ultimately guide our investigation of the mechanisms behind ischemia-reperfusion injury in the REBOA model.

Nhu Dang

Major: Chemistry

Mentor: Lee Miller

Research Type: Honors Thesis in Major

Study of Copper Gallium Selenide Photocatalyst Using Surface Photovoltage Spectroscopy

Copper Gallium Selenide (CGSe) is a promising photocatalyst for the sunlight-driven water-splitting reaction, a pathway to renewable hydrogen fuel. To study photochemical charge separation in CGSe films, surface photovoltage spectroscopy (SPS) was used to measure the photopotential across sample films (773 to 1245 nm) made by the drop-casting method. These films were also used to study the effect of surface modification with Na2S on photovoltage magnitude. Other aspects, including annealing temperature, type of substrate, and the use of sacrificial reagents were investigated to understand more about the charge-transfer process. While the surface treatment with Na2S fails to produce a significant change in the photovoltage and the reversibility, substrate choice and annealing temperature show critical impacts. Also, it is found that fluorine-doped tin oxide (FTO) substrate produces larger signal compared to indium-doped tin oxide (ITO) and gold (Au), and that 600°C is the best temperature to anneal FTO films.

Paris Dhillon

Major: Biochemistry and Molecular Biology

Research Type: Honors Thesis in Major

Journie Dickerson

Major: Neurobiology, Physiology and Behavior

Mentor: Lee Miller

Research Type: Honors Thesis in Major

The Effect of Noise Modulation on Recognition Memory and Speech Intelligibility

The manipulation of speech can be used to study the relationship between degraded Mandarin, speech intelligibility, and recognition memory. In this experiment, participants are presented with auditory Mandarin pseudowords. The control condition was unmanipulated and presented at 22,050 Hz. The experimental condition has been manipulated with the addition of frequency-modulated chirps at regular intervals of 24 ms to align with the onset of the speech stimulus, called Cheech (CHirp spEECH, “Cheech”). All participants will initially be presented with 64 counterbalanced pairs of Mandarin pseudowords and images. During the test phase, participants are presented with a combination of old and new pseudoword-image pairs and are asked to determine the membership of each test pair. While Cheech degrades the intelligibility of the presented pseudowords, we hypothesize that the addition of the chirps will also improve recognition memory capacity. Using D’ analysis, we compare the proportion of hits and false alarms made by each participant. Participants who recognize pairs more accurately will have a higher D’ score, indicating greater recognition. We hypothesize that participants in the Cheech group are expected to have a higher D’ score than participants in the control group, indicating a greater recognition of Cheech pseudowords than non-manipulated pseudowords.

Jillian Dyer

Major: Evolution, Ecology and Biodiversity

Mentor: Jennifer Gremer

Research Type: Honors Thesis in Major

The effects of nitrogen deposition and water availability on germination of exotic and native forbs and grasses in serpentine grasslands

Anthropogenic nitrogen deposition is increasing and global precipitation patterns are shifting in Northern California. Serpentine soils are harsh, nutrient poor environments known to have high native plant diversity. This study analyzed the germination of ten different common exotic and native grass and forb species found in a serpentine community at McLaughlin Reserve in order to determine how germination of native and exotic grassland plants is affected by nitrogen deposition and drought. Previous studies of the above-ground community at McLaughlin found that nutrient and water addition increased the proportion of exotic species. We predicted that native forbs would have high germination under drought while exotics would have high germination under nitrogen addition. Under combined drought and elevated nitrogen, we predicted that the exotic species would have lower germination because they would be co-limited by both water and nitrogen. This study will help land managers determine the cause of these above-ground changes in the context of climate change with more frequent drought and increased atmospheric nitrogen deposition.

| Matilda Fritz |

Major: Biological Sciences
Mentor: Laura Tully
Research Type: Honors Thesis in Major

Understanding Social Reward Learning: Sex Differences and Associations with Psychiatric Symptoms

Successful social interactions are inherently rewarding and require intact social reward learning; i.e., the incorporation of social feedback to regulate and motivate social behavior and maintain relationships. Impaired social reward learning may contribute to impaired social functioning, a feature of psychiatric disorders like Major Depressive Disorder (MDD). MDD is characterized by reduced motivation, blunted response to monetary rewards, and impaired social functioning, and affects females more frequently and severely than males. However, social reward learning in MDD remains understudied and sex differences are unknown. This study examines sex differences in social reward learning and how individual differences in social reward learning relate to depression, anxiety, and alexithymia symptoms. Participants will complete the Dynamic Social Learning Task, in which the participant's choice of slot machine results in videos of people saying positive, negative, or neutral statements. Their goal is to see positive or neutral outcomes; a higher percentage of trials with optimal outcomes indicates better social reward learning. We hypothesize: 1) females will demonstrate better social reward learning than males and if females have depression symptoms, that this sex difference will be reduced; 2) Across all participants, reduced social reward learning will be associated with more severe depression, anxiety, and alexithymia.

| Iris Juanico |

Major: Biochemistry and Molecular Biology
Mentor: Francis McNally
Research Type: Honors Thesis in Major

Understanding the Role of hsp-3,4 in the Positioning of the Spindle and Sperm Contents in Fertilized Meiotic C. elegans Embryos

In most animals, the meiotic division of the maternal DNA in the embryo is completed after fertilization by sperm. In C. elegans, the maternal meiotic spindle and sperm contents are kept on opposite ends of the embryo despite cytoplasmic streaming. This is thought to be important because exclusion of sperm DNA from the spindle may prevent chromatid division errors. This observation led to an investigation of the possible mechanisms tethering both the sperm contents and spindle. We hypothesize that the endoplasmic reticulum (ER), a membranous organelle that extends throughout the cytosol, has a role in maintaining the correct position of the sperm contents and meiotic spindle in the C. elegans embryo. This hypothesis is based on the fact that the ER is tethered to other membranous organelles by specific protein complexes, suggesting that it generates a structural scaffold in the cell. We found that depletion of the ER luminal protein BiP, encoded by hsp-3,4 in C. elegans, strongly disrupted ER structure. Depletion of these proteins caused mispositioning of the spindle but not sperm contents. Live imaging of the spindle and ER during meiosis will clarify the role of the ER.

| Sarah Goldberg |

Major: Biochemistry and Molecular Biology
Mentor: David Mills
Research Type: Honors Thesis in Major

Investigating Isolation Procedures of Pure Human Secretory Immunoglobulin A from Donor Milk

Necrotizing enterocolitis is a devastating disease afflicting over 5% of preterm infants (<33 weeks gestation) in developed countries, with high morbidity and mortality. Bioactive proteins in breast milk, including immunoglobulins, can reduce the incidence of disease by shaping the microbial community in the susceptible infant gut. A recent study has demonstrated the importance of milk secretory IgA (sIgA) in the prevention of disease development; however, this protection is markedly reduced in infants fed donor milk as processing degrades the bioactive molecules. This project aims to determine the most efficient strategy to isolate pure human sIgA from donor milk without harming the macronutrient levels or bioactivity of human donor milk through two alternate protocols, affinity chromatography extraction or magnetic bead sorting. An anti-human sIgA ELISA was used to quantify sIgA in donor milk. Donor milk was defatted by high speed centrifugation prior to affinity chromatography. Both defatted and whole milk were used in the magnetic bead isolation method. The purity of the extracted product was validated by SDS-PAGE. This product has potential use in downstream animal studies and human clinical trials on sIgA provision in premature infants in the prevention of necrotizing enterocolitis.

| Camilla Mancuso |

Major: Neurobiology, Physiology and Behavior
Mentor: Deborah S. Fetter
Research Type: UHP Capstone Thesis

Investigating the Relationship between Accuracy of Nutritional Value Estimates and Diet Choices in Two College Student Populations with Differing Nutrition Knowledge

In the United States, some of the most prevalent causes of premature death have been non-communicable chronic diseases such as Cardiovascular Disease, Type II Diabetes, stroke, and certain types of cancers. Research has shown that dietary patterns, physical activity, and weight management are all associated with relative risk of these chronic diseases. The Social Cognitive Theory postulates that in order to change a behavior effectively, one must first obtain behavioral capability. Thus, this theoretical model highlights the importance of dietary knowledge in the control of diet-related conditions. Although various studies have shown that people often underestimate caloric intake, there is a dearth in the literature regarding perception of other nutrients linked to chronic diseases. This study will investigate whether the accuracy of dietary estimates of nutrients, such as fat, sugar, sodium, and fiber, correlate with food decisions between a student group that has taken a college-level nutrition class and a group who has not. The results of the study will highlight potential gaps in nutrition knowledge and thus provide valuable tools for more efficient health-promoting strategies for the prevention and control of some of the diet-related leading causes of premature death in the United States.

Analisa Milkey

Major: Biological Sciences
Mentor: Peter Wainwright
Research Type: Honors Thesis in Major

Coral Feeding Shapes Foraging Behavior in Butterflyfishes

Butterflyfishes (family Chaetodontidae) are a species-rich group of fishes intimately associated with coral reefs. Butterflyfishes have been grouped into several trophic guilds, including obligate corallivores, which obtain >80% of their diet from hard corals, and benthic invertivores, which feed on attached and free-moving benthic prey. Corallivory has been extensively studied across reef fishes, but there is a lack of research on how corallivory affects foraging behavior. This study explored the relationship between feeding rate and swimming behavior across obligate corallivores and benthic invertivores using video data obtained from 14 species of butterflyfishes. Feeding rate and swimming behavior varied significantly between trophic guilds ($F=152.04$, $p=0.006$). Obligate corallivores had on average higher biting and turning rates than benthic invertivores. There was a significant positive relationship between feeding rate and turning rate across all species after phylogenetic correction ($F=7.681$, $p=0.017$). This study's novel approach to recording fish behavior elucidates how coral feeding has shaped foraging behavior in butterflyfishes.

Marjan Moghaddam

Major: Neurobiology, Physiology and Behavior
Mentor: Neil Hunter and William M. Debello
Research Type: Honors Thesis in Major

Prior Category Knowledge Aids New Learning

To make decisions in the real world, humans must be able to update their behavior based on new information. Prior work suggests that using inferred category knowledge can help update previously learned information based on a single observation. In addition, evidence suggests that delay-dependent processes may help with the formation of category knowledge. However, it is still unclear how inferred category knowledge influences new learning and what role delay-dependent processes serve in solidifying category knowledge. We developed a novel paradigm to test the influence of previously learned reward and category knowledge on new learning after a 24-hour delay. On Day 1 subjects viewed a sequence of three items and were asked to predict whether a sequence would produce a reward. Embedded in the sequences were items that changed the probability of reward and through trial and error subjects learned which sequences led to reward. Subjects returned on Day 2 to perform the same task, but the reward probabilities were altered. Category-learning performance was assessed after learning on both days. We predicted that participants' category learning performance on Day 1 would be related to their re-learning on Day 2. Preliminary analyses support our prediction.

Catherine Nugent

Major: Biochemistry and Molecular Biology
Mentor: Frederic Chedin
Research Type: Honors Thesis in Major

Exploring the Relative Contributions of DNA Topology and Sequence on R-Loop Formation

R-loops are three-stranded structures that form during transcription upon annealing of the nascent RNA with the DNA template strand. R-loops are a valuable subject of study due to their prevalence as universal structures in genomes. R-loops have been associated with important cellular functions in health and disease. Understanding the physical and chemical forces driving R-loop formation is therefore significant. Previous work shows that these structures are influenced by the local sequence and topology of the DNA template, though it is unclear to what extent each factor plays a part. The methods involved in this project include In Vitro Transcription (IVT) of a variety of plasmid constructs containing sequences known to form R-loops in the human genome. Comparing R-loop formation across sequences will allow us to determine the contribution of DNA sequence to structure formation. To measure the contribution of DNA topology, we manipulate the degree of superhelicity in the plasmids by inducing or removing supercoils in the DNA prior to performing the IVT assays. This project will allow for a better understanding of the foundations underlying R-loop formation.

Sharon Pala

Major: Neurobiology, Physiology and Behavior
Mentor: Joe Anistranski
Research Type: UHP Capstone Thesis

Relationship Between Language Development and Social Interactions in Dual Language Learner Preschoolers

Growing children reflect development through their verbal communication and social interactions with others. The purpose of this study is to explore the correlation between the social and language development domains in children who are dual-language learners. Peer and adult interactions and verbal communication during free play time of four preschool children at the UC Davis Early Childhood Lab School were observed over the course of nine weeks. These children began with limited to no English at the beginning of the academic school year (October 2019), but were provided intentional exposure to words and simple phrases by teachers in child-initiated play and teacher-initiated learning experiences. A positive correlation was found between English language development and the number of peer and adult interactions that the child engaged in during child-initiated play. The findings suggest that the best way for language development to occur in children would be to encourage and place them in environments where trusted adults are present, labeling and describing play, and facilitating peer to peer interactions.

| Abigail Pfefferlen |

Major: Biological Sciences
Mentor: Matthias Hess
Research Type: Honors Thesis in Major

Investigating the Role of Anaerobic Fungi in the GI Tract of Livestock

Thegutmicrobiome, or the bacterial population residing in the gastrointestinal tract, has been identified as a potential mechanism of disease through perturbation, as well as a target for improving therapeutics. Similarly, the gut mycobiome, or fungal inhabitants of the gastrointestinal tractdemonstrates equally compelling potential. The gut mycobiome is composed of primarily anaerobic fungi due to the anaerobic conditions present in the distal end of the tract where they are most concentrated. Anaerobic fungi have traditionally been challenging to work with in a laboratory setting due to difficulties with culturing and maintenance. The goal of this project was to isolate and characterize novel anaerobic fungi from the monogastric gastrointestinal tract to enhance our understanding of the gastrointestinal mycobiome and its role in gut health and function. Tissue and respective intestinal contents were collected from three regions of the gastrointestinal tract of an adult female domestic pig (Sus scrofa domesticus). Three experimental set-ups were used for selective enrichment of anaerobic fungi. Fungal isolates were subsequently introduced into an in-vitro gut model to further investigate their role in anaerobic digestion.

| Annabelle Rankin |

Major: Biological Sciences & English
Mentor: Gail L. Patricelli
Research Type: Honors Thesis in Major

Fight Club on the Lek: Understanding Patterns of Male-male Aggression in Greater sage-grouse (Centrocercus urophasianus)

Greater sage-grouse (Centrocercus urophasianus) are an iconic member of sagebrush ecosystems across western North America. During the breeding season (March-May), males gather on communal breeding grounds called “leks” where they engage in breeding displays to attract female and defend territories from rival males. Although previous studies have analyzed the high energetic costs of lek display, particularly during very low temperatures and showed that male grouse can alter display rates with the approach of females, little work has been done to analyze potential trade-offs associated with male-male aggressive behaviors. We collected data using motion sensitive cameras placed on eight different lek sites In California’s Eastern Sierra from early March to late May. We analyzed the incidence of male-male aggression as correlated with both ambient temperature and overall female attendance. We expect incidence of male-male aggression to positively correlate with ambient temperature and negatively correlate with female attendance due to associated energy tradeoffs. Given that sage-grouse are a near-threatened species, they are of particular conservational concern, and a fuller understanding of the temporal scope of their lekking behavior may offer significant conservation application.

| Mahssa Rezaei |

Major: Cell Biology
Mentor: Wolf-Dietrich Heyer
Research Type: Honors Thesis in Major

Characterization of the BRCA2 Tumor Suppressor Binding Partners, PALB2 and EMSY, in Regulating BRCA2 Multimerization

Homologous recombination (HR) is a mechanism that repairs double-stranded breaks in DNA. BRCA2 is a tumor suppressor protein that functions in HR and interacts with other proteins to maintain genome integrity. BRCA2 mutations can lead to higher risks of breast, ovarian, and other cancers. Microscopic studies have revealed that BRCA2 is commonly found in oligomeric clusters, with dimers and trimers being most prevalent. Recent studies by Le et. al (unpublished data) have identified BRCA2 self-interactions that occur between the N- and C- termini, and that are regulated by different binding partners. Two of these binding partners, PALB2 and EMSY, have binding sites that overlap on the BRCA2 N-terminus. PALB2 is required for BRCA2-mediated HR and mutations in PALB2 can lead to cancer. Contrastingly, amplifications in EMSY expression have been found to suppress BRCA2 and are linked to sporadic breast and ovarian cancers. We hypothesize that EMSY and PALB2 have opposing effects on BRCA2 multimerization via their interactions with the BRCA2 N-terminus. To study these effects, we created expression vectors of BRCA2 binding domains for EMSY and PALB2 to express in E. coli. We will conduct a pull-down assay of BRCA2 to test the effects of these proteins on BRCA2 multimerization.

| Paola Rodriguez |

Major: Neurobiology, Physiology and Behavior
Mentor: Lorena Marquez
Research Type: UHP Capstone Project

Diagnosis Specific Discharge Orders for the Improvement of Healthcare Quality at a Student Run Clinic

This project was created to improve the quality of healthcare for patients of Clinica Tepati. Clinica Tepati is a student-run clinic that provides primary healthcare to the underserved Hispanic population of the Sacramento area. This project allowed for the development of educational discharge orders for a variety of diagnoses. Furthermore, the discharge orders were created to account for those patients with language disadvantages. The first drafts of the discharge orders were created by medical students from UC Davis School of Medicine and California Northstate University College of Medicine that concurrently volunteer with Clinica Tepati. The first draft was then translated into Spanish by UC Davis undergraduate students that volunteer with Clinica Tepati. The collection of orders was then compiled and analyzed collectively to create a standardized template for discharge orders. Once finalized, the orders were approved by Physicians who volunteer with Clinica Tepati. To assess the efficacy of the orders, they were dispensed along with a short assessment survey. The surveys were then compiled to assess shortcomings of the orders and make adjustments accordingly. With this project, Clinica Tepati has created an extensive collection of discharge orders that will improve the healthcare experiences of the clinic’s patients.

| Jose Sandoval |

Major: Neurobiology, Physiology and Behavior

Mentor: Gino Cortopassi

Research Type: Honors Thesis in Major

Novel mTORC1 inhibitors kill Glioblastoma stem cells

mTORC1 has been the subject of much research as its upregulation has been linked to both cancer and aging. Thus, rapamycin, the mTORC1 specific inhibitor for which the protein complex is named after, has been tested as a potential cancer therapeutic and as potential therapy to increase longevity and reduces age-related disease. However, rapamycin also has immunosuppressive properties. Therefore, it is therapeutically important to identify novel mTORC1 specific inhibitors without rapamycin's immunosuppressive properties. Previously, the Cortopassi lab screened 1600 small molecule human drugs for potential mTORC1/2 binders using bilayer interferometry technology and further screened for mTORC1 specific inhibition through pS6K and AKT phosphorylation assays. The piperazine drug class was identified as a potentially novel class of mTORC1 specific inhibitors that we believe are interacting with mTORC1 at a different site (FAT domain) than rapamycin (FKBP12-Rapamycin binding domain). Analogs of the piperazine drugs have been synthesized. We now have several molecules that we believe bind to the FAT domain on the mTORC1 protein. My project is to identify mTORC1 specific inhibitors using pS6K and AKT phosphorylation assays. We will then determine the efficacy of the most potent mTORC1 inhibitors as potential cancer therapeutics in an in-vitro model of glioblastoma.

| Tara Shahrvini |

Major: Neurobiology, Physiology and Behavior & Spanish

Mentor: JoAnne Engebrecht

Research Type: Honors Thesis in Major

Function and regulation of C. elegans BRC-1-BRD-1 E3 ubiquitin ligase activity

Mutations in the human breast cancer susceptibility protein, BRCA1, and its binding partner, BARD1, result in breast and ovarian cancer. The only known enzymatic activity of the BRCA1-BARD1 complex is as an E3 ubiquitin ligase, which is crucial to its role in tumor suppression. The BRCA1-BARD1 complex plays an equally significant albeit less understood role in meiosis. In C. elegans, various brc-1-brd-1 mutants, orthologous to mammalian BRCA1-BARD1, display unusual meiotic phenotypes. Using an in-vitro approach, we investigated the effects of two mutants on the E3 activity of BRC-1-BRD-1: a triple alanine (I23A, L64A, K66A) predicted ligase-dead mutant within the RING domain and the hypomorphic brc-1(tm1145) allele, resulting in a 71 amino acid deletion C-terminal to the RING domain. Preliminary data suggest that the triple alanine mutant is phenotypically null, in agreement with research conducted on the mutant mammalian protein, while the brc-1(tm1145) is predicted to have E3 ligase activity. Thus, the E3 Ub ligase activity of the BRC-1-BRD-1 complex may be insufficient for maintaining meiotic integrity in C. elegans.

| Michael Stickels |

Major: Biological Sciences

Mentor: Neil Hunter

Research Type: Honors Thesis in Major

Investigating BRCA2's Role in Crossover Regulation in Mouse Spermatocytes

Meiosis is a mode of cell division required for the formation of haploid gamete cells. Accurate chromosome segregation requires that homologous chromosomes become paired and become connected by at least one crossover. Chromosome pairing and crossovers are both mediated by the repair of programmed DNA double-strand breaks in a process called homologous recombination. When more than one crossover occurs, their spacing is regulated by a process called interference that tends to minimize total crossovers. Defects in crossover patterning lead to infertility, pregnancy miscarriage, and congenital disorders. Brca2 (Breast Cancer Associated Gene 2) encodes a tumor suppressor known to mediate essential steps of homologous recombination – assembly of the DNA pairing and strand-exchange protein RAD51 onto the ends of DNA breaks. We sought to investigate the role of BRCA2 in crossover regulation during meiosis. A conditional Cre-lox mouse model was employed to mutate the essential Brca2 gene specifically during meiosis. Crossover patterning was analyzed by immunolabeling surface-spread spermatocyte chromosomes for the crossover-specific marker MLH1. Our analysis revealed that crossover interference is defective in Brca2 mutants, with the observation of closely spaced double crossovers. These surprising observations point to unanticipated roles for BRCA2 in later steps of meiotic recombination.

| Kathryn Strock |

Major: Neurobiology, Physiology and Behavior

Mentor: Nicole Polen-Petit

Research Type: UHP Capstone Project

Exposure of nurse-midwifery students to breastfeeding patients during clinical rotations — a mixed methods pilot study

Breastfeeding improves maternal and child health. While midwives are the frontline maternal care providers, they receive inadequate training in clinical lactation skills and report feeling a lack of confidence upon graduation. It is not known how much exposure midwifery students have to diverse breastfeeding patients during their training. The primary objective was to quantify and qualify midwifery students' exposure to breastfeeding patients during their required clinical rotations. The secondary objective was to determine their self-efficacy with clinical lactation skills upon graduation. Study participants were 8 midwifery students at the University of Michigan. Data on self-efficacy and patient encounters were collected via questionnaire with close-ended 7-point Likert scale, multiple choice, and open-ended questions. Descriptive statistics were used to calculate the mean and standard deviation. Midwifery students (N=8) reported feeling confident (6.26 out of 7) in 21 clinical lactation skills. Students interacted with breastfeeding patients in the labor and delivery unit during their clinical rotations. Analysis of patient encounters is ongoing.

| Laiba Tauseef |

Major: Biological Sciences
Mentor: Natalia Caporale
Research Type: UHP Capstone Thesis

Motivations and Barriers to Becoming Learning Assistants

Learning Assistants (LAs) have been shown to have positive impacts in undergraduate courses. In addition, recent studies have focused on understanding the impact of being an LA on the LAs themselves, finding increases in science identity and self-efficacy. Given these potential benefits, it is important that all students have the opportunity and are encouraged to become LAs at some point in their college career. At UC Davis, most LAs in STEM courses belong to majority demographics and have high GPAs. The reasons for this lack of diversity is unknown. Furthermore, there is little information about what motivates students to become LAs and what barriers students encounter that prevent them from doing so. This study will explore these questions by surveying and interviewing students who have and have not expressed interest in serving as an LA at UC Davis. The goal is to develop a set of guidelines to promote recruitment of a diverse student population for LA positions, with an emphasis in trying to increase the number of underrepresented students in STEM that participate. This project may be beneficial to LA programs that are trying to increase the amount and diversity of their students.

| Andy Yan |

Major: Neurobiology, Physiology and Behavior
Mentor: Dominik Haudenschild
Research Type: Honors Thesis in Major

Producing and Characterizing SMAD4-GFP Reporter For BMP Signaling Dynamics

Bone Morphogenetic Protein-2 is a pleiotropic growth factor that can induce bone growth. Recombinant human BMP2 (rhBMP2) is currently the only Food and Drug Administration (FDA)-approved osteoinductive growth factor used by clinicians as a bone graft substitute for fractures and spinal fusions. However, the exponential rise in rhBMP2 use is associated with an increased side effect profile that includes ectopic bone formation, osteoblast-mediated bone resorption, and inappropriate adipogenesis. As effective bone healing in humans requires a high concentration of rhBMP2 (1.50 mg/mL), which exceeds the physiological protein amount produced in nanograms under normal bone repair conditions by one million-fold, the incidence of side effects simultaneously increase. BMP2 regulates the expression of osteogenesis genes via SMAD4 protein recruitment and nuclear translocation. Having the cells express a SMAD4 protein tagged with a Green Fluorescent Protein (SMAD4-GFP) through transfection will allow us to monitor the SMAD4 nuclear translocation via fluorescent microscopy and the subsequent expression of osteogenesis genes. By monitoring the SMAD4-GFP nucleo-cytoplasmic shuttling, we hope to gain a better understanding of the BMP pathway to optimize the growth factor conditions needed for osteogenesis and to subsequently decrease the side effects from current treatments of rhBMP2.

| Felicia Yen |

Major: Cell Biology
Mentor: Kuang-Yu Jen
Research Type: Honors Thesis in Major

Application of Microscopy with UV Surface Excitation (MUSE) for Rapid Slide-Free Deceased Donor Kidney Biopsy Assessment

Histologic assessment of deceased donor kidney quality for kidney transplantation is currently performed using frozen sections since rapid reporting of the results is required. However, the reliability of the diagnoses is often suboptimal given several factors, including the limitations presented by frozen sections. Fresh kidney tissue obtained from otherwise discarded portions of nephrectomy specimens were used in this study. MUSE was chosen as the modality for microscopic imaging of the tissue given its ability to rapidly image a flat surface of fresh unfrozen tissue. Small portions of kidney parenchyma were subjected to several conditions for optimization of the protocol. All tissues were stained with Rhodamine and Hoechst and were subsequently imaged using a MUSE instrument. Images were color mapped to create an H&E stain appearance. Rapid microwave fixation and specimen sectioning with a vibratome created the best images for histologic evaluation without significantly lengthening the time required from start to finish, which is typically 15 minutes for a frozen section. These images showed no evidence of artifact since the tissue was not frozen and did not require sectioning using a cryostat. MUSE offers a promising alternative to rapid slide-free and artifact-free histologic evaluation of deceased donor kidney biopsies.these misconceptions.

College of Letters and Science

Belen Alcantar

Major: Sociology & Chicana/Chicano Studies
Mentor: Monica Torreiro-Casal
Research Type: Honors Thesis in Major

First-Generation and Working-Class Latino/a Student Experiences with Faculty and Mentorship at the University of California, Davis

Higher education institutions are modeled after the upper and middle classes that reinforce their ideology into education. Expectations from these institutions are shaped and influenced by beliefs held by individuals from "affluent" backgrounds. Those from a working-class background are at a disadvantage when they enter large universities. Considering that Latina/o/x students make-up a large portion of the working-class, along with being largely a first-generation group, how they navigate large institutions is crucial to understand. It is known that academic services and mentorship/guidance does help improve student experiences. This preliminary study serves to explore the narratives of Latino/a/x students navigating a large research institution in terms of faculty. Latino/a/x students were interviewed to understand their stories about their interactions and mentor relationships with faculty and other authority figures at UC Davis. Since Latina/o/x individuals account for about 25% in higher education institutions, including at UC Davis, it is crucial to understand how this population is navigating higher education since these realities can help institutions better adapt and serve students with these intersecting identities. UC Davis being on track to be a Hispanic Serving Institution reflects the immediate need to hear the voices of its students in order to better serve them.

Alexa Alcser

Major: Psychology
Mentor: Paul Eastwick
Research Type: Honors Thesis in Major

Intrinsic (but not Extrinsic) Religiosity Predicts Positive Support Outcomes After Romantic Breakups

A large body of research has demonstrated that religiosity can help individuals cope with significant life stressors. However, there is a deficit of empirical evidence exploring the connection between religiosity and coping with romantic breakups (e.g., divorce). Moreover, there is virtually no research examining early life relationships (e.g., dating). In the present research, we recruited undergraduate participants who had experienced a romantic breakup in the past 6 months and collected data from them via an at-home survey and an in-lab study. In particular, we asked about their religious beliefs and assessed several aspects of their romantic breakup. We found that their internalized religious beliefs (the importance of their faith in day-to-day life) were associated with feeling closer to their ex-partners and more supported by others, whereas their external religious behaviors (attending religious services) were not. Implications for the ways in which religion impacts well-being and relationship health will be discussed.

Katelyn Banh

Major: Managerial Economics
Mentor: Kristin Kiesel
Research Type: Honors Thesis in Major

The Effect and Implications of Streaming Services on Theatrical Box Office and Consumer Behavior

I analyze the effect of streaming services (specifically Netflix) on movie box office revenue. Predicting box office numbers was developed by studies in the 1970s and has been used ever since, but streaming has yet to be included as a variable due to its recent introduction to the industry's consumer base. Determining if streaming services are a substitute or complement to attending movie theaters will have important implications for consumer preferences and predictions of future changes in the film industry. Possible effects of streaming services on the movie industry is less theater attendance and less theatrically released independent movies. My empirical analyses utilize movie data from aggregator movie websites like The-numbers.com and data on Netflix subscribers over time reported on Statistica.com. This data set allows me to run regressions that estimate overall industry impact as well as effects specific to movie genres while controlling for movie budgets, time trends and seasonal effects, as well as independent releases. My preliminary results indicate that the popularity of streaming services like Netflix does not have a significant impact on box office revenue. I am currently extending my analysis to consider whether streaming services impact the number of type of movies released in theaters.

Gina Casaccia

Major: Psychology
Mentor: Tamara Swaab
Research Type: Honors Thesis in Major

Comparing Various Types of Feature Pre-Activation During Language Comprehension

| Sophia Chen |

Major: Statistics & Economics

Mentor: Christopher Hopwood

Research Type: UHP Capstone Thesis

Correlates of Health, Environmental, and Animal Rights Motives to Consider a Plant-Based Diet

The increasing popularity of plant-based (vegetarian or vegan) diets has coincided with a large literature on the motivationsfor dietary choices. However, most studies have focused on differences between plant-based dieters and omnivores. Less attention has been paid to differences between people who have different motives to switch to a plant-based diet. However, the correlates of different motives for the same behavior can reveal interesting patterns of moral cognition and have applied value (e.g., in marketing or advocacy). In a previous study, we identified three common motives for plant-based diet: health, the environment, and animal rights. We also identified patterns of psychological variables that distinguished these motives among people with arange of dietary preferences. The goal of this study is to replicate and extend these previous findings by examining the correlates of health, environmental, and animal rights motives to consider a plant-based diet. Preliminary results show that the health and animal motives have more significant correlates with personality and attitude measures than the environmental motive and being male is negatively correlated with the animal and environmental motives.

| Grant Cottier |

Major: Music & Chemistry

Mentor: Laurie San Martin

Research Type: Honors Thesis in Major

Horn Trio

The horn trio as a chamber ensemble is quite uncommon, only two well-known pieces for the instrumentation existing. This relative lack of comparable works provides a significant amount of musical ground to explore which, as a composer, is a valuable opportunity to develop and meaningfully contribute to an under-utilized genre. Writing for the combination of violin, horn, and piano presents a number of interesting challenges which do not appear in other combinations of instruments. Chief among these challenges lies in dealing with three very distinct timbres and attempting to produce something homogeneous in sound color. Similarly, the historical technical development of the horn imparts certain vagaries impeding effective writing for the instrument. To this end, I utilized a variety of contemporary instrumental techniques in conjunction with a fairly traditional approach to large scale form and structure to craft a piece representative of the potential offered by this unusual combination of instruments.

| Sanjna Duvvur |

Major: Neurobiology, Computer Science

Mentor: Xin Liu

Research Type: Engineering Design Project

Interactive Care (I-Care) Platform for remote caregiving of older adults with Alzheimer's disease

The Interactive Care (I-Care) platform is a web application built to support remote caregiving for those with dementia and Alzheimers. This platform will help increase user independence and ideally foster the connection between a patient and caregiver by creating a sense of belonging, reducing loneliness, and enriching relationships. The main features of this system include a calendar, a to-do list, communication tools, and a goal tracking system which are shared between patient and caregiver.

| Luis El Srouji |

Major: Applied Physics

Mentor: Shirley Chiang

Research Type: Honors Thesis in Major

Neuromorphic Computing for Real-Time Audio Separation

Though hearing impairments can be mitigated by amplification devices, modern hearing aids and cochlear implants fall short of full hearing restoration to the wearer in crowded or noisy environments. Modern systems can implement audio-separation or beamforming to identify individual sound sources within a mixed signal, but these are limited by tradeoffs between latency and accuracy. Leveraging the optimization techniques developed in machine learning research, a well-trained spiking neural network could potentially accomplish audio-separation in real-time and with lower power consumption than a traditional computer based on the Von Neumann architecture. A proper dataset would model a range of acoustic environments populated with various sound sources and retain information for the original sound sources it contains. Using acoustic ray-tracing techniques, I develop a model for the sound signals received by a linear, 8-channel microphone array to synthesize a large dataset for the implementation of an audio-separation network on Intel's spiking-neural-network research chip, Loihi.

| Uriel Matthew Enriquez |

Major: Pharmaceutical Chemistry

Mentor: You-Lo Hsieh

Research Type: Honors Thesis in Major

In Situ Synthesis and Coupling of Octadienyl Ether Cellulose Nanofibrils With Polymer Matrices

The increasing popularity of plant-based (vegetarian or vegan) diets has coincided with a large literature on the motivationsfor dietary choices. However, most studies have focused on differences between plant-based dieters and omnivores. Less attention has been paid to differences between people who have different motives to switch to a plant-based diet. However, the correlates of different motives for the same behavior can reveal interesting patterns of moral cognition and have applied value (e.g., in marketing or advocacy). In a previous study, we identified three common motives for plant-based diet: health, the environment, and animal rights. We also identified patterns of psychological variables that distinguished these motives among people with arange of dietary preferences. The goal of this study is to replicate and extend these previous findings by examining the correlates of health, environmental, and animal rights motives to consider a plant-based diet. Preliminary results show that the health and animal motives have more significant correlates with personality and attitude measures than the environmental motive and being male is negatively correlated with the animal and environmental motives.

| Jumana Esau |

Major: English

Mentor: Tobias Menley

Research Type: Honors Thesis in Major

Myth, Crisis, Utopia:Reimagining Worlds in Afrofuturist Climate Fiction

Climate fiction is a form of speculative fiction, or science fiction, that explores possible futures of the world based on risingCO2levels in the atmosphere. This genre is still coming into being, as it learns how to contend with the major challenges of representing anthropogenic climate change and expressing the “narrative agency of matter”1(Bergthaller 2).Non-linear elements such as climate change and planetary dynamism have been termed “unnarratable” because the modern novel is a structure based on linear causality.2However, scholar Amitav Ghosh offers a framework to contend with this representational challenge in The Great Derangement. Like Bergthaller, he identifies an issue in the conventional form of the novel, arguing that “probability and the modern novel are in fact twins” (16). The modern novel relies on probability, or realism,3to represent the world in its pages; in other words, novels require details of normal, everyday life to display their credibility. The problem with this model is that standard beliefs about “the orderliness and fundamental passivity of nature [are] no longer suited to the new era of ecological instability we have entered” (Bergthaller 2). Climate fiction cannot rely on the novel’s usual mirage of realism because realist literature does not represent the scale and forces of change in the Anthropocene. Climate change and natural processes resist representation because hey “exceed the capacities of literary imagination,” which then “force[s] a cognitive transformation” for the contemporary writer (Bellamy 417). This crisis of imagination permeates into the novel and its conventional structures of representation.

| Kenton Goldsby |

Major: Religious Studies & Spanish

Mentor: Eva Mroczek

Research Type: Honors Thesis in Major

Queer Christians do not Always do Queer Interpretation: Hermeneutical Differences Between Gay Christian Men and Transgender Christians

Recent interpretation of Christian doctrine and the Bible by lesbian, gay, bisexual, transgender and queer (LGBTQ) individuals does not represent a singular voice. In fact, different groups under the LGBTQ banner have varied rhetorical goals when conducting interpretation. I argue that gay men and transgender people, as two different groups, occupy two distinct hermeneutical or interpretive spaces. Gay men are rooted in LGBT interpretation which focuses on apologetics, also thrusting them into an assimilationist position in the Christian LGBTQ community. This is a position they remain in to this day, as seen through the recent work by David and Constantino Khalaf, who maintain the same rhetorical goals as another recent gay man author, Matthew Vines. On the other hand, transgender Christians interpret through a queer theory/queer criticism-based model. In this model, “queering” scripture and rejecting heteronormativity are the focal points of interpretation. I propose that this model of interpretation is seen through a recent work of transgender, Christian authorship: the book Transforming by Austen Hartke.

| Ronald Guerra |

Major: Computer Science

Mentor: Xin Liu

Research Type: Engineering Design Project

Aggie Dish App

The Aggie Dish app is a mobile application built from the ground up that provides information about the menus at various on-campus eateries. This app allows users to plan when and where to eat at on-campus, check whether the available eateries have food that fits any dietary restrictions, and see which food items are popular among the community. The team set up a backend stack hosted by Firebase and developed a web scraper to collect data from the official UC Davis dining menus online to populate the database. The frontend was implemented programmatically and through storyboard in XCode using Swift. Our infrastructure consists of three main layers: the web scraper, the database, and the frontend, which all interact through our server API. After scraping menu data from the UC Davis dining website, our web scraper interacts with our server API to enter that data into our database. The frontend for our iOS app then communicates with the server API to retrieve menu information in a user-customized way from that database. This allows for flexibility within the app should the structure of any of these three layers change in the future.

| Jameson Hammond |

Major: Political Science & Economics

Mentor: Amber Boydstun

Research Type: Honors Thesis in Major

Period Poverty: The Effect of Price on Tampon Consumption Between Different Income Groups

This paper examines the relationship between price and consumption in the market for tampons within the United States. With a consumer base of almost half the population and a trillion-dollar industry, it is surprising that there is still little to no research on this unique good. Using cross-sectional data from 2017, I study how price affects the number of tampons women in different incomes purchase. After conducting an ordinary least squares regression, I conclude that price does significantly affect tampon consumption. However, to my surprise, I find that as prices increase, higher income women actually decrease consumption of tampons at a greater rate than lower income women.

| Elias Heffan |

Major: Computer Science

Mentor: Xin Liu

Research Type: Engineering Design Project

iOS Aggie Dish App

This paper examines the relationship between price and consumption in the market for tampons within the United States. With a consumer base of almost half the population and a trillion-dollar industry, it is surprising that there is still little to no research on this unique good. Using cross-sectional data from 2017, I study how price affects the number of tampons women in different incomes purchase. After conducting an ordinary least squares regression, I conclude that price does significantly affect tampon consumption. However, to my surprise, I find that as prices increase, higher income women actually decrease consumption of tampons at a greater rate than lower income women.

| Stephanie Jennings |

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

Mentor: Rana Jaleel

Research Type: UHP Capstone Thesis

Asylum Under the Trump Administration

President Donald Trump's asylum rules and regulations have had repercussions for migrants who are lawfully seeking refuge in the United States. Undoubtedly, these policies are being litigated in federal court to determine whether or not these policies are in accord with the United States Constitution. The purpose of my research is to unpack President Donald Trump's asylum rules and regulations in the context of United States immigration law, specifically in regards to queer migrations. Queer migration scholarship may help us situate the United States history of exclusion to the present day as well as understand the broader societal implications of these court decisions. Thus, queer theory will serve as my analytical framework for examining the federal court cases that have arisen out of the Trump Administration's asylum policies.

| Isabella Johnson |

Major: Anthropology

Mentor: Cristiana Giordano

Research Type: Honors Thesis in Major

Immigration Policy Through the Eyes of Health Care Practitioners: Limbo and Liminality in Treating Immigrants

Status epilepticus is defined as a continuous seizure lasting longer than a half hour, or multiple seizures happening in a timespan that does not allow for recovery between seizures. Both cases have a high mortality rate, and thus the condition is very severe. Status epilepticus can result from an underlying epilepsy condition, or from various chemical agents. Tetramethylenedisulfotetramine, also known as TETS, is a neurotoxin that commonly induces status epilepticus. Historically it has been used as a rat poison, but has been banned more recently due to its high toxicity to humans. In fact, various TETS poisonings occurred in China in the early 2000s, with each event resulting in high mortality. It is imperative to find a way to stop convulsions if TETS is ever used as a weapon again, in order to decrease mortality.

Ryan Jung

Major: Chemistry

Mentor: Michael Rogawski

Research Type: Honors Thesis in Major

Comparison of Methods for Seizure Brainwave Analysis

Status epilepticus is defined as a continuous seizure lasting longer than a half hour, or multiple seizures happening in a timespan that does not allow for recovery between seizures. Both cases have a high mortality rate, and thus the condition is very severe. Status epilepticus can result from an underlying epilepsy condition, or from various chemical agents. Tetramethylenedisulfotetramine, also known as TETS, is a neurotoxin that commonly induces status epilepticus. Historically it has been used as a rat poison, but has been banned more recently due to its high toxicity to humans. In fact, various TETS poisonings occurred in China in the early 2000s, with each event resulting in high mortality. It is imperative to find a way to stop convulsions if TETS is ever used as a weapon again, in order to decrease mortality.

Aravind Krishnachandran

Major: Statistics

Mentor: Can M. Le

Research Type: Honors Thesis in Major

Bethe-Hessian r Optimization

Detecting communities within a graph or network of data is an important data analysis method that can be applied to many fields of industry. Spectral clustering is a technique used to cluster the data points within a graph into different communities or clusters based on similar factors and connectedness to other data points. One particular spectral clustering algorithm known as the Bethe-Hessian provides estimates of the number of communities and classification of data points to clusters based on the eigenvalues and eigenvectors of the matrix Hr = (r2-1) In + D – rA. The efficiency of this algorithm is influenced by the tuning parameter r. I investigate the ideal r value for various sets of tidy and untidy data, and ultimately analyze the properties of the estimated communities as the r value changes. These properties are analyzed by studying the eigenvalues and eigenvectors of the Hr matrix, along with k-means clustering based on these eigenvectors.

Agnes Lam

Major: Design

Mentor: Gozde Goncu-Berk

Research Type: Honors Thesis in Major

Chinese Flower Symbolism Fashion Collection

Symbolic imagery is deeply ingrained in Chinese culture. There is an abundant amount of floral symbolism that pervades both cultural practices and artistic expression. Therefore, it is worth studying how symbolism, more specifically floral symbolism, is applied in Chinese textile arts. Through globalization, the modern world demands fusion between cultures. I study the significance of floral symbolism in Chinese textile arts and crafts through literature review and visual analysis to design a fashion collection. This collection will have four garments in total, where each piece will focus on the representation of seasons with floral symbolism as such the orchid represents spring, the lotus represents summer, the chrysanthemum represents autumn, and plum blossoms represent winter in Chinese culture. The significance of my project is to show how the pieces of a fashion collection are able to change with the seasons promoting the meanings of flower symbolism in the traditional Chinese textiles arts and crafts.

Frances Lansdowne

Major: Psychology

Mentor: Eva Schepeler

Research Type: Honors Thesis in Major

Home Environment and Oral Proficiency: Emerging Bilinguals from Immigrant Families

Since the 1950s, research has explored methods to improve English proficiency for dual language learners (DLLs). More research is needed on, however, the factors that influence language development among the various DLL groups, including their language exposure and home experiences. To address the gaps in the literature, this study examined the roles of language exposure, language usage, and home practices on children's bilingual proficiency. A total of 28 DLLs from Mexican-American and 61 DLLs from Chinese-American families were recruited from Head Start centers in Northern California. Parents were interviewed about their child's hourly language exposure, usage, and home literacy practices. Children were assessed on their bilingual proficiency with the Picture Vocabulary, Oral Comprehension, and Understanding Directions subtests of the Woodcock-Johnson Test. Results show no significant difference in the bilingual proficiencies between the two groups. There were differences in the language practices between the two groups. Correlation results show significant relationships between oral proficiency and reading frequency, books in the home, language exposure, language usage, and storytelling in both English and the home language. Results suggest that DLLs from Mexican-American and Chinese-American families have more similarities than differences, and support previous findings that the home environment influences DLLs' bilingual proficiency.

| Samuel Little |

Major: Chemistry

Research Type: Honors Thesis in Major

| Melissa Loomis |

Major: Cognitive Science

Mentor: Simona Ghetti

Research Type: Honors Thesis in Major

The Role of Childhood Stress and Sex Hormones on Memory and Hippocampal Development

Childhood environmental factors such as stress and socioeconomic status (SES) have been linked to changes in brain development and performance on cognitive tasks. Previous research has shown that higher SES is associated with better memory performance in middle childhood. In addition, pubertal hormone levels have been linked to cognitive sex differences. We collected memory performance on a variety of tasks, questionnaires assessing environmental variables, and structural MRI scans from children aged 7-15 across three time points (T1: N=155, T2: N=122, T3: N=92). We found that stress, measured as number of stressful life events, showed a sexually dimorphic pattern, with greater stress in females correlating with lower memory performance over time, and greater stress in males correlating with greater memory performance over time. We predict that this pattern is related to differing testosterone levels during puberty. Additionally, we found that one measure of SES, mother's education, was positively correlated with memory performance. Our current study hypothesizes that lower SES, measured as a combination of parental income and education, is correlated with lower memory performance and smaller hippocampal volumes. This study will help elucidate the factors that underlie the lasting disparities arising from childhood differences in stress and SES.

| Nicole Matsuda |

Major: Sociology & Communications

Mentor: Nicholas Palomares

Research Type: Honors Thesis in Major

Instagram Use

This study is focused on the effects of Instagram usage on women's body image. Past studies have shown that exposure to messages about body ideals on social media applications, such as Instagram, is correlated with increased levels of body-dissatisfaction and self-objectification among women. We are interested in determining whether perceived similarity and level of endorsement on Instagram mediates the effects of exposure to messages about the body and femininity in a longitudinal quasi-experimental study. We will ask a sample of female undergraduates to follow a set of existing Instagram accounts from one of four conditions: highly-endorsed accounts promoting a body ideal; accounts that are not highly-endorsed that promote a body ideal; highly-endorsed accounts promoting body-acceptance; and accounts that are not highly-endorsed that promote body-acceptance. We will collect data from four points in time across six weeks to determine the effects of exposure to these messages. Findings from this study will potentially help better inform social media users about the effects of exposure to messages about the body.

| Joshua Melton |

Major: Economics

Mentor: Carolyn Thomas

Research Type: UHP Capstone Project

Cadet Guide Development for Air Force ROTC Detachment 088 Officer Candidates

The Reserve Officer Training Corps is a program through which college students can earn a commission into the United States military. Detachment 088 at California State University Sacramento is the host for University of California Davis students in the Air Force ROTC program. The military as an organization has a formal and standardized system for relaying information, however many of these publications are irrelevant or otherwise presented in a fashion that lacks a logical presentation of order and organization for ROTC. The purpose of this project was to create a comprehensive guide for Detachment 088 cadets that is useful throughout the four-year course of the program. Published career guidance is primarily intended for recruiting and information on quotas, and lacks a valuable personal perspective for commissioning cadets. In addition to the agglomeration of relevant literature, the guide includes testimonials from active duty Airmen to shed a real-world light on cadets' potential career fields. The final product was assessed on utility among its intended audience, officer candidates from Detachment 088.

| Esmeralda Mendoza |

Major: Political Science
Mentor: Brad Jones
Research Type: UHP Capstone Thesis

White Identity and Immigration Politics

White identity plays a crucial role in understanding how white identifiers form support and opposition towards policies. Whites with strong racial solidarity support legislation that will protect their group's interest, and are a central factor in elections. When proposed legislation aims to reduce racial inequality, White Americans view it as a direct threat to their superior position in the United States. Similar to a zero-sum game, Americans believe that when another community receives more, White Americans will inherently receive less. Thus, strong levels of ethnocentrism are positively correlated to support restrictive immigration policies. Immigration is perhaps one of the single most important issues that can change how a political party is perceived. The increasing Latino support for the Democratic Party has led the majority of Latinos elected officials to become Democrats and support immigration. Therefore, when Whites believe that increasing immigration is causing negative effects in American society, they have a higher motivation to support the Republican Party because the party opposes immigration.

| Kaelan Mikowicz |

Major: Computer Science
Mentor: Xin Liu
Research Type: Engineering Design Project

Pirated Video Detection

Video pirating constitutes large losses for content owners, and accurate methods for detecting pirated videos are not available as standalone applications to the general public. Our project is an open source application that efficiently detects pirated content while avoiding the excessive hardware requirements of other approaches. The system allows a user to add proprietary videos to a database, then query the database with content suspected of piracy. Our algorithm represents scenes and frames as histograms of their features, then isolates pirated content using Smith-Waterman sequence matching at the scene level. These methods allow us to deal with a variety of potential attacks, including frame rate changes, scale changes, rotation, and warping.

| Michael Montgomery |

Major: Marine and Coastal Science—Oceans and the Earth System
Mentor: Scott Herring
Research Type: UHP Capstone Thesis

Living in the Glacial Landscape

The pathway of crime for juveniles in California is not as simple as getting arrested, charged, then released as there are other factors involved such as public defender fees, administrative fees, and lasting consequences. This research assess how the higher rates of incarceration, arrests, and probation affect Black and Latinx juveniles. This research will examine how the disproportionate effects on Black and Latinx youth in the juvenile system affect them and their families. In addition, this research will assess the pathway of crime and how it imposes unnecessary fees that disproportionately affect Black and Latinx youth facing the justice system than it does to White youth. I will be analyzing this because it is important to assess the barriers in place that make it more difficult for individuals to go through the pathway of crime. The pathway of crime includes the option of bail, yet, those who cannot afford it are subject to paying jail fees that causes for further debt and criminalization. Nevertheless, this research proposes feasible solutions that can be implemented to allow for equity among Black and Latinx juveniles that will minimize or fully eliminate the disproportionalities they have compared to White youth facing the justice system.

| Thuy Vi Nguyen |

Major: International Relations
Mentor: Vajra Watson
Research Type: UHP Capstone Thesis

Cultivating Identities in a Place called Home: Intersectional, Everchanging Identities of Vietnamese American Youth in Culturally Sustaining Spaces

Educators and scholars have been advocating for culturally sustaining pedagogies in the classroom that extends, honors,and sustains the cultures and backgrounds of our growing Studentsof Color population. Moving beyond pedagogies in classrooms, I examineculturally sustaining spaces in culture clubs and community-based organizations and how theycultivate the identity development and sense of belonging ofVietnamese American high school students. I find that thesestudentshave complex identities that areintersectional and everchanging, existing outside the Black-White binary. Vietnamese culture clubs provide a space that allows students to belong andexpress their identityin a positive way, butwith curriculum as colonizer, schools have not yet become aplace of belonging forall students. Community-based organizations provide alternative spaces that center the experiences of Vietnamese American students, allowing them to engage with their complex identities in a place that becomes like a home.

| Kelly Nishimura |

Major: Landscape Architecture
Mentor: Patsy Eubanks Owens
Research Type: Honors Thesis in Major

College Decisions and the Campus Outdoor Built Environment

Ischemia–reperfusion injury occurs when perfusion is restored to the tissue after a period of ischemic events. Despite the benefit of preventing tissue necrosis, reperfusion can trigger additional tissue injury through inflammation and thrombosis. In our study, the porcine model relevant to resuscitative endovascular balloon occlusion of the aorta (REBOA), a hemorrhage-control technique involving occlusion of the aorta that can induce reperfusion injury. The goal of this project was to identify vascular injury and characterize its features to develop a consistent histopathological scoring system. To localize injury in the vasculature, paraffin-embedded abdominal-aorta tissue sections from treatment group and sham pigs were stained with the immunofluorescent intercellular adhesion molecule, ICAM-1, and the immunofluorescent fibrin. Immunofluorescent staining with ICAM-1 demonstrated the presence of proinflammatory effects such as potential inflammatory leukocyte recruitment. The quantification of immunofluorescent fibrin accumulation allows us to deduce the likelihood of thrombotic formation. Our histopathological scoring system is based on typical vascular injury features such as increased expression of endothelial cell adhesion molecules and increased expression of thrombosis-inducing fibrin. This scoring system will allow us to identify vascular injury and ultimately guide our investigation of the mechanisms behind ischemia-reperfusion injury in the REBOA model.

| Stephanie Quero |

Major: Political Science – Public Service & Chicana/ Chicano Studies
Mentor: Professor Cuevas
Research Type: Honors Thesis in Major

Youth of Color in Depth and in Jail

The pathway of crime for juveniles in California is not as simple as getting arrested, charged, then released as there are other factors involved such as public defender fees, administrative fees, and lasting consequences. This research assess how the higher rates of incarceration, arrests, and probation affect Black and Latinx juveniles. This research will examine how the disproportionate effects on Black and Latinx youth in the juvenile system affect them and their families. In addition, this research will assess the pathway of crime and how it imposes unnecessary fees that disproportionately affect Black and Latinx youth facing the justice system than it does to White youth. I will be analyzing this because it is important to assess the barriers in place that make it more difficult for individuals to go through the pathway of crime. The pathway of crime includes the option of bail, yet, those who cannot afford it are subject to paying jail fees that causes for further debt and criminalization. Nevertheless, this research proposes feasible solutions that can be implemented to allow for equity among Black and Latinx juveniles that will minimize or fully eliminate the disproportionalities they have compared to White youth facing the justice system.

| Kausalya Raman |

Major: Design & Economics
Mentor: James Housefield
Research Type: Honors Thesis in Major

Using Design to Make Research Papers Accessible

Research is a website that aims to present currently relevant research papers in a well-designed, easy to understand format, with simplified, non-academic, and unbiased language. Research is the driving force behind much positive change in the world, and many impactful research papers are published every year. However, this research tends to exclusively be targeted towards an academic audience, and is inaccessible to many others, from voters of varying education levels, to customers of businesses that claim to be backed by research in order to mislead, to aspiring activists who are asking questions that research may have already answered. This project aims to answer the questions: Is there a way to use design to make important research more accessible to the general public? Would increasing access to such research push innovation forward at a faster pace? The deliverables for this project include the design of the website with a focus on Economics research papers that are currently relevant to policy issues being debated leading up to the 2020 elections, and user research and testing in Economics classrooms.

| Megan Reeve |

Major: English & Philosophy
Mentor: Matthew Vernon
Research Type: UHP Capstone Thesis

The Role of Myth-Making in Modern Fantasy

Modern fantasy often employs references to ancient mythology, be it Norse, Greek, or Roman. These stories often become sources themselves, spawning fan fiction and modern myth-making of their own. This project focuses on the ways stories and motifs from ancient cultures are carried over, changed, and repurposed in the modern fantasy series The Lord of the Rings and Harry Potter. Why did Tolkien and Rowling find it necessary or helpful to 'return to myth'? I start with trying to understand the status of myth in relation to history, storytelling, and memory as sources of truth within the story. This will then affect how we can read each of these series as myths of contemporary society that have spawned reams of storytelling and myth-making of their own. This will also clarify what kinds of reading are advocated in each series as they deal with the presence of myth and the truth-value of storytelling as compared with other forms of knowledge, such as the scientific method or scientific skepticism.

Dorothy Riley

Major: Psychology
Mentor: David Furlow
Research Type: UHP Capstone Project

Impediments Towards Women's Right

Ideology of the last 250-300 years is that human rights come from a ruler or government mechanism for privileged members of a society, with men having the greatest rights of all. In modernity, the juxtaposition of cultural specificity and the universality of human rights illustrates a disturbing central tension in human rights. This tension highlights the global challenges women face in acquiring universal individual human rights, as they are not absolute in certain states, nor under certain conditions. This lack of equal rights stems from cultural norms established by, state-sanctioned violence, jurisprudence lacking in female representation, religious dogma, theocratic governments, and patriarchal societal structures. Intergovernmental organizations claim to address equal rights in a multitude of international legal instruments.

Ivan Rocha

Major: Psychology & Chicana/Chicano Studies
Research Type: UHP Capstone Project

Using Narrative Interviews to Understand Chicana/o Studies Courses' Psychological Impact on Students

Chicana/o courses at the University of California, Davis besides providing students an opportunity to understand the cultural representations, values, socio-economic issues, history and experiences of the Chicano and Latino community in the United States; they intend to empower students—especially Chicana/o and Latino students—to succeed academically and successfully navigate racially hostile systems. However, little research has been done to examine the effectiveness of these courses in supporting students' psychological well-being and academic success. Therefore, the primary goal of this study was to find if there are elements in Chicana/o Studies courses that support students' psychological well-being and academic success. A total of 8 students—who had taken at least one Chicano/a Studies course—participated in this study. Participants were interviewed with a set of 11 open-ended questions. Responses were recorded and then transcribed. We tested the hypothesis that participants would identify different elements of Chicana/o Studies courses that have supported their psychological well-being and success.

Caroline Rutten

Major: Sociology
Mentor: Robert Faris
Research Type: Honors Thesis in Major

Relationships That Matter: Impacts of Social Capital on Single Mothers in Community College

Between studying and parenting, student single-mothers are required to balance a great deal of conflicting responsibilities. Given the lower tuition and programs that target the population, community college tends to be a common setting for student single-mothers to pursue an education. Institutional aid that community colleges and the state provide are often perceived as the most effective ways to support the unique needs of this student group. My research aims to study another form of support — social capital — and how it impacts the experience of student single-mothers in their balance of multiple responsibilities. However, not all relationships within a student single mother's social network can be viewed as neither beneficial nor equally supportive in the same way. This research attempts to analyze which relationships within a student single-mother's social capital — between friends, parents, significant others, and community college faculty and professors — pose themselves as the most supportive and what type of support they provide. Through a qualitative analysis using in-depth interviews with eight single mothers enrolled at a community college in Northern California, I intend to contribute to the design of institutional strategies concerning how to best support this student population.

Marina Schroder Bydalek

Major: Linguistics
Mentor: Robert Bayley
Research Type: Honors Thesis in Major

Style-Shifting in Japanese Interlanguage: Comparing Study Abroad and Domestic Outcomes

Style-shifting in Japanese is the alternation between levels of formality in conversation. Due to its significance in Japanese pragmatic norms, learning how to select and employ these styles appropriately becomes an important component of language proficiency, especially for intermediate and advanced Japanese language learners. While students are often instructed on these speech styles in their Japanese courses, the range of speech styles they encounter may be limited. Study abroad can be an excellent opportunity to utilize these different registers more regularly, as the types of interactions and interlocutors a student would encounter will vary throughout the day, from honorific speech with instructors to casual speech with friends. Ultimately, however, individual factors play an important role in the pragmatic development of learners, both domestically and abroad. Personal motivation and habits, learner personality, and the nature of interactions learners partake in can all influence style-shifting patterns, which can enhance—or, according to preliminary results, negate—the benefits of study abroad. Using a mixed methods approach, this study examines how style-shifting patterns differ between study abroad participants in Japan and students learning Japanese at home, as well as what aspects of their experiences may contribute to these differences.

| Jeffrey Seidl |

Major: International Relations

Mentor: Deborah Swenson

Research Type: Honors Thesis in Major

Determinants of Global Views on Trade in Advanced Democracies

As democratic policy formation is at least in part driven by popular opinion, a deeper understanding of public views on trade in democracies has become more important than ever in an international order increasingly defined by globalization. Using individual-level survey data, this project explores demographic determinants of views on trade in select developed democracies. Specifically, the project focuses on the relationship between educational attainment and views on trade. Existing theories on the subject predict that higher-skilled individuals in advanced economies stand as those with the most to gain from the expansion of trade while those with relatively lower levels of skill are among those with the most to lose. Assuming that educational attainment is positively associated with individual skill, it is expected that those with higher levels of educational attainment in developed democracies will tend to view international trade more favorably than those with lower levels of educational attainment. Using a hierarchical linear model, preliminary results suggest that higher levels of educational attainment are indeed associated with more positive opinions on trade in developed democracies.

| Matthew Self |

Major: Physics & Mathematics

Mentor: David Wittman

Research Type: Honors Thesis in Major

Dark Matter -- Galaxy Offsets in Illustris TNG-300 Clusters

Conclusive evidence exists that approximately 85% of the matter in the universe is composed of an unknown substance which interacts with the known particles only gravitationally, dubbed dark matter because it neither emits nor absorbs light. Little is known about the properties of this dark matter, and a simple model known as cold dark matter (CDM) is in agreement with all existing observation. Deviations from CDM such as non-gravitational self-interactions may leave observable imprints on the distribution of offsets between clusters of galaxies and their host dark matter halos. We select a sample of 250 massive clusters in the Illustris TNG-300 large-volume cosmological simulation in a way which mimics observation. We then characterize statistical properties of various measures of galaxy-dark matter offsets expected in CDM and search for combinations of measures which could be used to constrain alternative models of dark matter by comparing with observation. We explore how offsets depend on cluster properties such as mass and relaxedness and comment on cluster populations which might be promising for future study.

| Nikita Shetty |

Major: Psychology

Research Type: Honors Thesis in Major

Development of How Children Solve a Shape Sorter Task Between 12 and 48 Months of Age

Object insertion is an important ability that we utilize constantly in everyday life. We insert keys into locks, feet into shoes, and pieces into puzzles. While a seemingly basic skill, object insertion is actually a complex process. It requires identifying which objects and openings match, using working memory to plan the alignment and insertion of the object, and executing the motor actions to successfully manipulate and insert the object. Örnkloo and von Hofsten (2007) found that children begin to succeed at object insertions at around 22 months of age, when they begin to preadjust the objects before insertion. We examined the development of these abilities, using a more naturalistic task, in children aged 12 to 48 months. An experimenter presented the child with the shape sorter and shaped blocks that fit into its openings. We recorded the session and coded children's behavior for which opening(s) they attempted to insert each object, and how long it took them to make each insertion. The findings from our broad age range will provide us with a greater understanding of the development of children's object insertion abilities. Ongoing analyses will reveal whether children's insertions become more accurate and efficient with age.

| Jagveer Singh |

Major: Computer Science

Mentor: Xin Liu

Research Type: Engineering Design Project

EV Explorer: A Comprehensive Cost Analysis Tool for Prospective Car Buyers

The long term costs of owning a vehicle depend on many factors including the buyer's location, the type of vehicle, fuel economy, and driving patterns. Moreover, different vehicles have differing environmental impacts and carbon footprints, which carry important implications for society and are issues that many buyers care about. It is difficult to consider all of these variables when purchasing a vehicle. EV Explorer provides a comprehensive solution by helping buyers visualize cost savings and environmental saving associated with various vehicles. It uses information pulled from multiple sources including government APIs, and takes into account the exact driving behavior of the user. The results are displayed in dynamic and easy-to-understand visuals that help users quickly understand the financial and environmental implications of their decisions.

Nathan Soland

Major: Chemistry

Mentor: Frank Osterloh

Research Type: Honors Thesis in Major

Investigating Unusually Large Surface Photovoltages in Rhodium-doped Strontium Titanate

Chemistry is often taught an isolated fashion, which is disconnected from the real world, causing students to lose their interest in the subject matter. However, there is actually a great opportunity for educators to spark an interest in their classrooms and contribute to global efforts in achieving UN's Sustainable Development Goals (SDG's). Overcoming complex and multifaceted sustainability issues requires collective efforts of dedicated scientists, economists, politicians, and environmentalists. An earlier study done by our group showed that implementing a learning activity connecting chemistry topics to phosphate sustainability, a socio-scientific issue, has positive effects on both students' motivation and chemistry self-efficacy due to the subject's increased relevancy to students. Based on the positive outcome, the group decided to extend the project to include a larger number of SDGs and connect them to a variety of science topics through the creation of Prezi learning environments. These self-exploratory learning environments will provide students a global vision and an environmental awareness to help them build a healthier future for their communities and the planet. As part of this study, it is also planned to examine the effectiveness of these learning materials on students' understanding of scientific topics, sustainability awareness, and perception of science relevancy.

Eric Thai

Major: Political Science

Mentor: Heather Elko McKibben and Ethan Scheiner

Research Type: Honors Thesis in Major

The False Promise of Trade for Labor Rights Protection

As preferential trade agreements (PTAs) proliferate, labor rights protection in developing states deteriorates. To ameliorate the global deterioration of labor standards, labor provisions are increasingly included in PTAs signed between developed and developing states; however, it remains unclear whether the inclusion of labor provisions in trade agreements actually improves workers' conditions on the ground in developing countries. Because developing states sign onto PTAs with labor provisions for the trade and market access, this paper tests the extent to which trade, and its salience for developing states, can incentivize improvement in labor rights protection when conditioned on the likelihood of labor provisions enforcement by the developed states. I argue that when the trade relationship is salient and when enforcement threat is credible, developing states would empty-shell their labor provision commitment. That is, I predict that developing states would adopt labor provisions into their domestic laws without implementing them in practice. I found evidence in support of my hypothesis; subsequently, I also found that developing states also worsen their labor protection in practice.

Emma Tribble

Major: Chemistry

Mentor: Ozcan Gulacar

Research Type: Honors Thesis in Major

Exploring the Effects of a Neglected Area: The UN Sustainable Development Goals in Science Education

Chemistry is often taught an isolated fashion, which is disconnected from the real world, causing students to lose their interest in the subject matter. However, there is actually a great opportunity for educators to spark an interest in their classrooms and contribute to global efforts in achieving UN's Sustainable Development Goals (SDG's). Overcoming complex and multifaceted sustainability issues requires collective efforts of dedicated scientists, economists, politicians, and environmentalists. An earlier study done by our group showed that implementing a learning activity connecting chemistry topics to phosphate sustainability, a socio-scientific issue, has positive effects on both students' motivation and chemistry self-efficacy due to the subject's increased relevancy to students. Based on the positive outcome, the group decided to extend the project to include a larger number of SDGs and connect them to a variety of science topics through the creation of Prezi learning environments. These self-exploratory learning environments will provide students a global vision and an environmental awareness to help them build a healthier future for their communities and the planet. As part of this study, it is also planned to examine the effectiveness of these learning materials on students' understanding of scientific topics, sustainability awareness, and perception of science relevancy.

Jency Umana Linares

Major: Psychology & Chicana/Chicano Studies

Mentor: Camelia Hostinar

Research Type: UHP Capstone Thesis

Acute Stress and Cognition in Children

Executive function is an umbrella term for a group of mental processes necessary to enable thinking, acting and problem-solving. Several studies have indicated that acute stress may have an impact on executive functioning in adults. However, little research has been done to examine the effect of acute stress on executive function in children. The goal of this study was to examine the impact of acute stress and parental support on executive functioning in children ages 9-10 years old. In this study, a total of 181 participants attended a laboratory visit. Children were randomly assigned to one of three conditions: one where they completed the Trier Social Stress Test for Children and prepared for it alone (high stress condition), one where they prepared with their parent, and a non-stress control condition. Subsequently, children were presented with four executive function tests measuring working memory, inhibitory control, and cognitive flexibility. We tested the hypothesis that children in the non-stress condition would perform better on the executive function tests compared to children in the high-stress condition. We also predicted that children who experienced parental support would perform better on the executive function tests compared to those in the alone condition. Statistical analysis indicated that acute stress and parental support did not significantly impact performance on executive function tasks. However, this study may have had some limitations, such as a limited age range and a primarily high-SES participant group. Future research should consider looking into individual differences in reactivity to the Trier Social Stress Test, expand the age range and test a more diverse group.

| Julie Xu |

Major: Design & Economics

Mentor: Thomas Maiorana

Research Type: Honors Thesis in Major

Sustainability in the Boba Industry

The purpose of this research is to improve the sustainability of the boba industry through human-centered design practice. Boba, or bubble tea, is a trendy drink from Southeast Asia, which is typically iced tea mixed with sugar and milk or other flavourings, alongside tapioca balls or other supplemental desserts at the bottom. Since boba drinks are typically served in disposable cups paired with plastic straws, this product creates growing waste that goes into landfills. Unlike the coffee industry, boba industry has been in the market for a shorter period of time; therefore, less research and innovations have been done to improve its sustainability. To understand the motivations of boba users, I collected qualitative data from conducting user interviews and I obtained quantitative data from various surveys and life cycle analysis. Then, using the synthesized data in the user experience report, I will arrive at a solution. While the specific solution has yet to be determined due to the methodology of this research, the goal is to develop a working prototype that helps making the boba industry more sustainable.

| Susanna Zheng |

Major: Psychology

Mentor: Karen Bales

Research Type: Honors Thesis in Major

How does Early Parental Care Alter Oxytocin Receptors and Bonding

| Emma Zamora |

Major: Chicana/Chicano Studies

Mentor: Maceo Montoya

Research Type: Honors Thesis in Major

Poster Art: A Comparison Study of the Impact of Political Art in Past and Present Chicanx Movements

This study examines literature related to past Chicanx political movements and the central role art played in illustrating and furthering their causes while building solidarity and a sense of community identity. Using relevant literature and interviews, it analyzes Malaquias Montoya's poster artwork for Centro Legal de la Raza around immigrants' rights, as well as his work for the Third World Liberation Front Strike in counteracting Eurocentric education and helping to create ethnic studies departments at various universities. Topics explored include investigation of whether similar political posters are still being created for Chicanx movements, such as immigration policies, immigrants' rights, and Deferred Action for Childhood Arrivals (DACA), and examination of their purpose and efficacy today in comparison to the past. It also explores the impact of digital and social media as mediums for political protest art and how these mediums affect modern Chicanx political movements' ability to raise awareness, mobilize support, and build community identity.

College of Engineering

Andrei Blebea

Major: Computer Science and Engineering

Mentor: Xin Liu

Research Type: Engineering Design Project

Identification of Pirated Video Content

Video pirating constitutes large losses for content owners, and accurate methods for detecting pirated videos are not available as standalone applications to the general public. Our project is an open source application that efficiently detects pirated content while avoiding the excessive hardware requirements of other approaches. The system allows a user to add proprietary videos to a database, then query the database with content suspected of piracy. Our algorithm represents scenes and frames as histograms of their features, then isolates pirated content using Smith-Waterman sequence matching at the scene level. These methods allow us to deal with a variety of potential attacks, including frame rate changes, scale changes, rotation, and warping.

Aidan Callahan

Major: Electrical Engineering

Mentor: Lance Halstead

Research Type: Engineering Design Project

1/10th Scale Autonomous Racing Vehicle

For our senior design project, we designed a 1/10th scale autonomous race vehicle designed to navigate a track composed of one inch-wide white lines as quickly as possible. Our project is designed to be durable and tunable so that we can test our car easily and extensively. Our car's 3D printed components are constructed using durable PLA filament to withstand impacts during testing. The OpenMV (our onboard microprocessor) and PCB mounts are designed to be as open as possible, allowing for easy access to connectors, header pins, and wires. The angle of the OpenMV camera can be easily adjusted using a revolute joint. Our code utilizes a Bluetooth module to modify Kp (P controller constant), Kd (D controller constant), slope, brake threshold, brake duration, duty cycle minimum, and duty cycle maximum values on the fly. We designed our PCB to make tuning easier by including silkscreen descriptors of header pins. We also increased the durability of our PCB by using thick, short traces to reduce the possibility of a burn out. Our car achieved an average speed of 7.2 feet per second at the second time trial through the use of these design principles.

Kay Hadrick

Major: Biomedical Engineering

Mentor: Jennifer Choi

Research Type: Engineering Design Project

Hippro Hip Protector (Team 11)

Falling sideways directly on one's hip can injure even a young, healthy adult, but for older adults, a fall like this can be life-threatening. Hip protectors offer protection from hip fractures by diverting the impact of a fall away from the hip, lessening the risk of injury. However, current hip protectors are ugly, uncomfortable, or unappealing leading to low patient compliance with device use. There is a need for a comfortable and easy to use hip protector that safely distributes force away from the hip for elderly patients with a high risk of falling to encourage patient compliance and prevent injury. We intend to design a lighter weight and thinner profile hip protector as compared to existing designs while providing appropriate impact resistance. In order to meet these goals, we developed the Hippro, a novel design intended to be discrete, comfortable, and as effective as the current gold standard. Through its open and comfortable design, we have designed a device that can be worn for most, if not all, of the day including during sleep and while using the bathroom. However, we also aimed to design Hippro in such a way that elderly patients can take it on and off as needed amidst daily tasks. By making the device both easy and discreet to use during daily life, we hope to make it easier to integrate a Hippro hip protector into patients' routines and, as a result, reduce the risk of injury from fall for elderly patients.

Navjot Kaur

Major: Electrical Engineering

Mentor: Lance Halsted

Research Type: Engineering Design Project

Autonomous Vehicle Design NATCAR

The goal of this project is to design an autonomous car that follows a line track using data from a 2D camera. This was achieved by assembling and implementing a motor control PCB to control the DC motor and servo motor using an OpenMV microcontroller.

| Emma Kristovich |

Major: Computer Science and Engineering

Mentor: Xin Liu

Research Type: Engineering Design Project

Identification of Pirated Video Content

Video pirating constitutes large losses for content owners, and accurate methods for detecting pirated videos are not available as standalone applications to the general public. Our project is an open source application that efficiently detects pirated content while avoiding the excessive hardware requirements of other approaches. The system allows a user to add proprietary videos to a database, then query the database with content suspected of piracy. Our algorithm represents scenes and frames as histograms of their features, then isolates pirated content using Smith-Waterman sequence matching at the scene level. These methods allow us to deal with a variety of potential attacks, including frame rate changes, scale changes, rotation, and warping.

| Noah Larson |

Major: Civil Engineering

Mentor: Miguel Jaller

Research Type: Engineering Design Project

Senior Design - Civil Engineering

My group proposes a re-design of a Winters, CA street in line with Complete Streets concepts. Our team is consulting for Caltrans by performing the typical traffic analyses and design work associated with state road projects. We design alternatives to meet community and project goals, including safety, environmental, and accessibility improvements. We analyze the role of vehicular traffic and projected future travel behavior on the street's potential level of service (LOS) for each design alternative. We also discuss the implications of using LOS as a metric in Complete Streets, which aim to decrease vehicle miles travel. A multi-objective optimization is used to recommend an alternative for the project. Future steps outside of the scope of our project include community hearings and environmental review (CEQA).

| Chandni Nagda |

Major: Computer Science and Engineering

Mentor: Xin Liu

Research Type: Engineering Design Project

Identification of Pirated Video Content

Video pirating constitutes large losses for content owners, and accurate methods for detecting pirated videos are not available as standalone applications to the general public. Our project is an open source application that efficiently detects pirated content while avoiding the excessive hardware requirements of other approaches. The system allows a user to add proprietary videos to a database, then query the database with content suspected of piracy. Our algorithm represents scenes and frames as histograms of their features, then isolates pirated content using Smith-Waterman sequence matching at the scene level. These methods allow us to deal with a variety of potential attacks, including frame rate changes, scale changes, rotation, and warping.

| Nancy Ng |

Major: Chemical Engineering

Mentor: Jason White

Research Type: Engineering Design Project

Sustainable Ammonia Production: A NH3asty Business

Every year, about 174 million metric tons of ammonia is produced globally, making it the second-most-produced man-made chemical. More than 85% of that ammonia is used in fertilizers, used to grow foods that sustain half of the world's population. In Minnesota alone, approximately 295,000 metric tons of anhydrous ammonia is employed annually, with 70% of it going to corn fertilization. Unfortunately, ammonia synthesis is, traditionally, extremely energy intensive, accounting for 5% of natural gas consumption, 3% of total greenhouse gases emitted, and 3% of the world's energy consumption.

Our goal is to adopt novel modular and green technologies to produce 50 metric tons NH3/day of 99.5 wt% purity, locally in Minnesota. To do this, we apply stranded wind as a renewable energy source and make use of water electrolysis for H2 production. We apply pressure swing adsorption to separate N2 from air. The H2 and N2, which make up the synthesis mixture, are converted to NH3 via a scaled-down Haber-Bosch process that minimizes energy consumption and costs by incorporation of heat integration during recycle. In addition to fabricating a process flow diagram and modeling our operation in Aspen Plus, we also analyze economic, social, environmental, and health and safety considerations associated with our grassroots plant. The overall profitability, determined by metrics such as net present value and discounted cash flow rate of return, as well as sustainability of our design allow us to establish the viability of the process.

| Shaye Spani |

Major: Biomedical Engineering

Mentor: Jennifer Choi

Research Type: Engineering Design Project

UroVis: Home-based Uroflowmetry

Clinical uroflowmetry is the state-of-the-art non-invasive screening procedure involving measurement of patient's urinary flow rate over time for lower urinary tract symptoms (LUTS). LUTS affect 50% of men over fifty, with increasing prevalence to approximately 80% of men over the age of 70. While in-clinic uroflowmetry devices provide accurate flow rate detection and meet guidelines outlined by the International Continence Society (ICS), the flow rates they detect may not be truly representative of the patient's urodynamics, or maybe noninterpretable. This misrepresentation can be due to the patient's inability to void at the clinic, less than adequate void volume at the time of clinical assessment, and non-repeatability of measurement within the scheduled appointment time. UroVis is a home-based uroflowmetry device that addresses the need for a more inexpensive, convenient, and accessible uroflowmetry device that upholds or surpasses the gold-standards of in-clinic uroflowmetry accuracy and precision for LUTS screening within the comfort of the patient's home. The UroVis home-based uroflowmetry device helps to maximize the number of uroflowmetry tests performed for better screening while minimizing the number of visits the patient has to make to the clinic.

| Aya Suzuki |

Major: Biological Systems Engineering

Mentor: Stavros Vougioukas

Research Type: Engineering Design Project

Thermoelectric Plant Watering System

At home plant watering systems need an update. Current watering systems available are not feasible for long periods of being away from home. Most systems require the user to store the entire amount of water needed to hydrate the plant during the absence of the owner and also solely rely on gravity rather than specifying the amount of water needed for that specific plant and do not allow for the control of water flow. The main goal of this project was to design an easy to use plant watering system for when nobody is home to take care of the user's plants. The watering system would ideally have been Arduino-controlled, solar powered, dispensed accurate amounts of water, and operated using thermoelectric coolers to extract water from the moisture in the air. We began building the prototype earlier in the year and tested the performance of a Peltier system we built. Due to COVID-19 restrictions, we were not able to complete the construction of our prototype. We have instead adjusted our project to focus on a MATLAB and Tinkercad simulation of the Peltier system we would have constructed. The simulation focuses on analyzing and optimizing the efficiency of the Peltier system under different conditions including varying current, ambient temperature, and air flow.

| Rachel Talbot |

Major: Chemical Engineering

Mentor: Jason White

Research Type: Engineering Design Project

Modular Design for a Green Ammonia Synthesis Plant

Ammonia, a chemical commonly used in fertilizer, is traditionally produced by an energy intensive process with a large carbon footprint. Traditional ammonia synthesis is heavily dependent on natural gas for both power and the synthesis of hydrogen, so it is produced along the Gulf Coast, far from where it is used. Due to the toxicity of ammonia, transportation to where ammonia is needed is both expensive and hazardous. We were tasked to propose a modular design of an ammonia synthesis plant in the Minnesota River Valley, closer to where the ammonia would later be utilized. We designed a process that will optimize the traditional Haber-Bosch method while creating 50 metric tons per day of 99.5% purity anhydrous ammonia. We propose the use of a proton exchange membrane electrolyzer to synthesize high-purity hydrogen from water. Nitrogen, the only other reactant, will be separated from air using pressure swing adsorption. We use a cesium-promoted ruthenium catalyst to produce ammonia at a lower temperature and pressure and increase the safety and decrease utility costs associated with the ammonia synthesis. In addition to synthesizing hydrogen and nitrogen from renewable sources, we plan on implementing wind or solar energy to power the plant.

| Allison Tearjen |

Major: Chemical Engineering

Mentor: Ronald Faller

Research Type: Engineering Design Project

Senior Engineering Design Project

| Derek Wadsworth |
Major: Chemical Engineering
Mentor: Matt Ellis and Ahmet Palazoglu
Research Type: Engineering Design Project

Model and Retrofit of a Dimethyl Carbonate Production Plant to Minimize CO2 Emissions

With the increasing push for cleaner industrial processes, incentives for the production of environmentally friendly DMC production have become increasingly more lucrative.There are a large variety of applications of DMC in modern manufacturing processes ranging from the production of electric car batteries to use as a fuel additive.Future demand for DMC is expected to rise, particularly if more economical production processes are established. In industry, modern DMC production processes have shifted towards the conventional dividing wall column (CDWC) process. However, there is an opportunity to lower the annual cost by reducing plant utility demand and creating an additional revenue from a side product stream through the use of reactive distillation and side reactor (RDSR) technology. This project focuses on the retrofitting of a hypothetically implemented CDWC DMC production facility in Peculiar, Missouri to produce 15,000,000 kg/yr of 99.5 mol% DMC utilizing the new RDSR technology. Aspen Plus was used to simulate both the CDWC and RDSR processes and determine estimates of capital and utility costs. The social and environmental impacts were then researched and evaluated. Lastly, an economic evaluation was performed to determine the feasibility of the retrofit. Profitability measures, such as the before-tax return on investment (BTROI) and net present value (NPV) were calculated in order to provide a justified recommendation. Results hope to reveal that the decreased utility demand of the RSDR process will make the direct synthesis of DMC from methanol and carbon dioxide economically feasible to implement.