2018
2019

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

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College of Agricultural and Environmental Sciences

| Anika Agrawal |

Major: Environmental Toxicology
Mentor: Gary Cherr and Eric Sanford
Research Type: Thesis in Major

Microplastic Ingestion in Mole Crabs, Emerita analoga

Increased global plastic production and mismanagement of the resulting waste has drastically impacted marine ecosystems. Microplastics, a large class of plastic pollutants, are less than 5mm in size and organisms often mistake them for prey or accidentally ingest them during filter feeding. This therefore exposes them to harmful contaminants that are contained within plastics or those that adsorb onto the surface of plastics. Mole crabs (Emerita analoga), filter feeders that inhabit the swash zone on the sandy coastline, bury themselves in the sand and therefore are being exposed to microplastics. They are an important food source for shorebirds along the California coast, and information about these organisms can provide valuable information about other crustaceans' responses to microplastics. This study looks at whether mole crabs ingest microplastics in a laboratory setting and if there are any differences in microplastic ingestion between different populations of mole crabs found on parts of the coast with differing plastic pollution. It is hypothesized that ingestion of microplastics in the laboratory will lead to decreased fitness. Furthermore, there will be differences in ingestion between populations depending on the areas from which they are collected. Experiments are still being conducted and data is forthcoming.

| Autumn Amerman |

Major: Animal Science
Mentor: Edward J. DePeters
Research Type: UHP Thesis

Goat Colostrum Density

A goat's placenta does not allow immunoglobulins to pass from the dam to the newborn. Consequently, goat kids are born either aggamaglobulinemic or hypogammaglobulinemic. Colostrum, the first secretion produced by the mammary gland prior to parturition, contains immunoglobulins (Ig). The intake and absorption of Ig through colostrum, provides passive immunity and protects the kids from pathogens in the environment. The aim of this study is to determine whether or not density could be used to determine the IgG concentration and thus the quality of colostrum being fed to newborn kid goats. Colostrum samples were collected immediately following parturition from goats at the UC Davis Goat Barn and from SkyHill Napa dairy. A digital refractometer will be used to measure Brix. A pycnometer will be used to measure liquid density. IgG concentration will be determined using an enzyme-linked immunosorbent assay, ELISA, kit. The relationship between either Brix and density and Ig concentration will be evaluated. Establishing whether colostrum density is an effective form of determining colostrum quality is an important step towards allowing producers to analyze their colostrum quality quickly and accurately on site and allowing them to put into effect appropriate management practices that support the health of newborn kids.

| Raven Barbera |

Major: Animal Science
Mentor: Anne Todgham
Research Type: Thesis in Major

The Physiological and Behavioral Responses of Diploid (8N) and Triploid (12N) White Sturgeon, Acipenser transmontanus, to Hypoxia

This study investigates the physiological and behavioral effects of hypoxia on diploid (8N) and triploid (12N) white sturgeon, Acipenser transmontanus. Hypoxia, or low oxygen conditions, is one of the major environmental factors currently affecting native sturgeon, and fish ploidy is known to impact performance under suboptimal conditions. Triploid white sturgeon are found both in the wild and in caviar farms but the impacts of polyploidy on mechanisms of stress tolerance are not well explored in sturgeon. For aquaculture, it is thought that there are benefits in producing caviar due to potential female-biased sex ratios and higher growth rates, but lower stress tolerance may be a cost associated with triploidy that warrants investigation. In this study, we induced triploidy in white sturgeon and performed experiments to determine the comparative physiological (hypoxia tolerance) and behavioral (activity and water surface behavior) responses of diploid and triploid sturgeons to low oxygen. Through this study I hope to gain a greater understanding of the impacts of hypoxia on diploid and triploid white sturgeon and to apply this data to enhance predictions for survival of the closely related and currently threatened green sturgeon, Acipenser medirostris, population in the Sacramento River.

| Noah Bennett |

Major: Environmental Science and Management
Mentor: Susan Harrison
Research Type: Thesis in Major

The Effect of Herbivory and Resource Competition on the Survival and Fitness of Quercus douglasii Seedlings

The Blue Oak (Quercus douglasii) is a widely revered shade-tree endemic to California. Throughout its natural range, Q. douglasii recruitment rates are too low to replace current adult populations. To prevent Q. Douglasii from becoming a species of concern, action must be taken to identify the cause and potential solution to early life-stage population decline. This study looked at the effect of herbivory and resource competition on Q. Douglasii seedlings. Common acorn predators include mule deer, acorn woodpeckers and various species of rodent. Data was collected on 156 acorns planted at Quail Ridge Natural Reserve in treatments excluding predators and competition. Acorns were placed under cages to prevent predation, in plots cleared of competing biomass or given both treatments. Height measurements were taken bi-weekly and used as a measure of fitness. Research is still in progress at the time of submission, however it is hypothesized that acorns will have greater survival and growth rates with protection from herbivory and lack of resource competition. The results of this experiment can advise restoration ecologists on best practices to maximize Q. douglasii seedling yield and health.

| Keara Bergin |

Major: Nutrition Science: Nutritional Biology
Mentor: Gerardo Mackenzie
Research Type: UHP Thesis

Impact of High-fat Diet on Pancreatic Protein Expression and its Relationship to Pancreatic Cancer

Obesity is a major human health problem, and its systemic effects extend to the pancreas. The objective of our study was to identify pancreatic proteins that are differentially expressed (either overexpressed or underexpressed) and could have a role in the development of pancreatic cancer in mice fed a high-fat diet (HFD). Male C57BL/6J mice (5 mice/group) were fed diets containing either approximately 10% total calories from fat (control) or 60% total calories from fat (lard) (HFD). After 15 weeks of dietary intervention, mice were euthanized and pancreata were collected and subjected to a proteomics analysis. Pancreatic proteins were extracted and subjected to TMT/iTRAQ profiling, and data were analyzed with iPathwayGuide; the top 25 proteins showing the greatest overexpression values and the top 25 proteins showing the greatest underexpression values were analyzed further. Among the multiple biological processes/pathways that were found to be significantly altered, proteins that regulate pancreatic secretion, such as CEL, CELA2A, CPA1, PRSS2, and proteins that participate in the regulation of reactive oxygen species (ROS), including GSTP1, PRDX2, VDAC1, were the most significantly affected by HFD. Additionally, five differentially expressed proteins (RPS13, TMEM97, EIF5A, UFM1, RAB1A) based on their key role in cancer and their correlation with pancreatic cancer survival curves were analyzed. Consumption of HFD alters pancreatic protein expression. This data provides a valuable resource of candidate proteins and pathways that may be altered in obesity and inflammation as a result of HFD.

| KathrynElizabeth Berry |

Major: Wildlife, Fish and Conservation Biology
Mentor: J. David Furlow
Research Type: UHP Thesis

Effects of Bifenthrin on Susceptibility of Japanese Medaka (Oryzias latipes) to Edwardsiella piscicida

The substantial application of pesticides in Northern California's agricultural industry generates considerable ecological concerns due to runoff, which exposes non-target organisms, such as fish and other aquatic organisms, to potentially harmful pesticides. Pesticides can increase the production of reactive oxygen species in fish, leading to oxidative damage, which can have indirect and direct effects such as neurotoxicity, cancer, birth defects, organ damage, and suppression of the immune system. Therefore, I wanted to test if fish exposed to a pesticide that causes oxidative stress would be more susceptible to infectious pathogens. The model organism Japanese Medaka (Oryzias latipes) will be used to examine whether exposure to the pesticide bifenthrin enhances the mortality induced by the bacteria Edwardsiella piscicida. The preliminary results show sub-lethal doses of bifenthrin inhibited the activity of several enzymatic antioxidants. I am currently performing the subsequent test to determine if the bifenthrin-exposed fish subsequently exposed to Edwardsiella piscicida will result in increased mortality. I will present the results of this test at the conference, as well as discuss the ecological impacts of pesticides on non-target organisms.

| Julia Cohen |

Major: Animal Biology
Mentor: Russ Hovey
Research Type: Thesis in Major

Estrogen and Prolactin Cooperatively Activate STAT5 in the Mammary Epithelium of Pigs

Milk production by epithelial cells within the mammary gland (MG) is essential for the reproductive success of mammals. Hormones from the ovaries (estrogen, E; progesterone, P) and the pituitary gland (prolactin, PRL) play important roles in MG development and also cooperatively regulate milk production and the onset of breast cancer. Following a study in which we demonstrated increased proliferation of MG epithelial cells in pigs when E + PRL were administered in combination, I hypothesized that this treatment would also increase phosphorylation of the transcription factor Signal Transducer and Activator of Transcription 5 (pSTAT5). Tissue sections from the MG of n=12 peripubertal gilts treated with saline, E, PRL, or E + PRL (n=3 per treatment) were analyzed by immunohistochemistry. The proportion of epithelial nuclei containing pSTAT5 was significantly ($p<0.0001$) greater in the MG of pigs treated with E + PRL (79.5%) versus saline (2.2%) or E (0.8%). There was no effect of PRL treatment (39.8%). Understanding the cooperative actions of E and PRL improves our understanding of offspring development supported by lactation, as well as the regulation of breast cancer risk in women.

| Francesca D'Cruz |

Major: Sustainable Agriculture & Food Systems
Mentor: Tom Ich
Research Type: Thesis in Major

Understanding the Needs of Entrepreneurs, Investors, Businesses, and Organizations with intentions to Operate the Next Economy Space

The Next Economy MBA course, hosted by the impact consulting firm LIFT Economy, is an online educational platform that serves to educate prospective and current entrepreneurs in pursuing regenerative, self-reliant, and equitable business practices. This course has the opportunity to further benefit stakeholders that include underrepresented populations, but it must be targeted to reach this broader audience. We determined the needs of past participants through surveying and informal interviews. This information was cross-referenced to my personal analysis of LIFT's current outreach operations. Then, through collaboration with LIFT, we decided on an effective marketing strategy for this course that is aimed at expanding the reach to developing economies in sustainable agriculture and food systems. Additionally, by assessing current and future modes of outreach, we provided guidelines to inform a potential project for a future Capstone Team with our client.

Yulissa Diaz

Major: Animal Science
Mentor: Elizabeth Anne Maga
Research Type: UHP Thesis

The Effect of Milk from Lactoferrin Trangenic Cows on the Fecal Microbiota of Young Pigs

Despite numerous advances, the problem of malnutrition continues to be a risk factor in children of many underdeveloped countries. Malnutrition can negatively impact the intestinal epithelium by decreasing nutrient absorption, and making it more susceptible to diarrheal illnesses caused by pathogens. An attempt to combat these affects is through the use of milk containing human lactoferrin (hLF). Lactoferrin is a glycoprotein present in human milk that has antimicrobial properties that have been thought to promote a healthy epithelium. Using a pig model of malnutrition, as they closely resemble the digestive tract of humans, feces were collected from the experimental malnourished pigs after three weeks and again after five weeks. These groups consisted of full fed (controls), malnourished (no milk), cow milk group, and hLF milk group. These samples will then be run under a polymerase chain reaction to amplify the DNA. The samples will then be barcoded and sorted into bacterial groups based on taxonomy. The overall goal of this project is to determine if the lactoferrin protein positively influenced the microbial populations in the gut compared to cow milk in attempts to recover the state of a healthy epithelium.

Evan Dumas

Major: Biotechnology
Mentor: Kate Scow
Research Type: Thesis in Major

Organic Fertilizers Lead to Greater Ecological Stability for Soil Bacterial Communities as Compared to Inorganic Fertilizers

Soil structure, which enhances agriculturally important soil properties like water retention and topsoil preservation, is maintained in part by the glue-like secretions of soil microbes; nevertheless, these microbes rely on the availability of organic compounds in the soil to generate these secretions. Organic fertilizers, like manure and compost, provide a mixture of organic compounds and have been shown to improve soil structure, while inorganic fertilizers, which contain specific macronutrients necessary for plant growth such as nitrogen or phosphorus, lack these organic compounds and can lead to soil structure degradation. Due to their difference in organic matter content, inorganic and organic fertilizers have varying impacts on the composition of microbial communities in the soil; however, research is lacking on the effect of these fertilizers on the ability of microbial communities to resist compositional change. This attribute of microbial communities, referred to as resistance, serves as an indicator of ecological health. We sought to determine how different fertilization regimes affect the ability of soil bacterial communities to resist changes in response to plant growth and cultivation. Our results suggest that organic fertilizers foster a bacterial community with greater resistance to seasonal changes than inorganic fertilizers.

Ariel Escalante

Major: Wildlife, Fish and Conservation Biology
Mentor: Kristina Horback
Research Type: UHP Project

Designing an Enriched Enclosure for Zoo-Housed Giraffes (Giraffa camelopardalis)

In captivity, giraffes may develop abnormal or stereotypic behaviors, such as repetitive surface-licking, if their environment is not meeting their behavioral needs. Although the baseline for captive giraffe care has not yet been established, recent research suggests the importance of enrichment in the zoo enclosure to enhance the animals' mental and physical well-being. The goal of this project is to design and construct a 3D model of an enriched giraffe enclosure that provides opportunities for the giraffes to express species-specific behavior and complies with current Association of Zoos & Aquariums (AZA) standards. The model is alterable to accommodate differing demographics and climates among wildlife facilities. This was done by visiting five local AZA facilities and recording enclosure dimensions, cost, enrichment, demographics, food, and guest interaction using photography and employee interviews. Additional information about giraffe care was gathered from various published works. Preliminary results indicate that feeding enrichment (i.e. feeders that encourage manipulation with the giraffe's tongue) is instrumental in maximizing well-being, as well as other forms of sensory enrichment. These aspects, therefore, play a major part in the model. This project may be beneficial to facilities in the future who are looking to update or build a giraffe enclosure.

Natalie Fortman

Major: Environmental Policy Analysis and Planning
Mentor: Alan Meier
Research Type: Thesis in Major

Do Low-Income Energy Efficiency Programs Reduce Energy Burdens for Beneficiaries and Surrounding Communities?

Low-income households spend a disproportionately high percentage of income on energy bills compared to the average household, leaving less money for necessities like food. To help combat this issue, California implemented the Low-Income Weatherization Program for Multi-Family Properties (LIWP-MF), a program that provides energy efficiency and renewable energy upgrades to low-income housing properties. This paper seeks to identify a reduction in energy burden for low-income residents as a result of LIWP-MF upgrades. To determine this, estimated household energy expenditures are calculated for residents of 22 low-income housing properties that recieved LIWP-MF upgrades and their surrounding communities. All of the selected properties fall within PG&E territory and to comprise only a miniscule fraction of all households within their community. With a scope limited to a few dozen properties around the state, this program does not reduce energy expenses for entire low-income communities. Calculations for individual properties reveal that spending on energy services does decrease as a result of the upgrades, however, the value of the energy savings is not enough to have widespread effects at the community level.

| Sandya Ganesh |

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

Measuring Air Pollutant Levels for Rhesus Macaques Exposed to Ambient Wildfire Smoke

Early life exposure to wildfire smoke can have long-term detrimental effects to both immunity and airway physiology. Additionally, wildfire smoke (WFS) is capable of long range transport and can significantly increase ambient particulate matter (PM2.5) and ground-level ozone (O3) in distant counties. In the summer of 2008, infant rhesus macaques (age 3±1 months) were exposed to PM2.5 and O3 derived from a series of wildfires in Trinity/Humboldt counties, located approximately 200 mi. from the California National Primate Research Center. Pollutant levels were recorded by the California Air Resources Board monitoring site #57,577 around 2 mi away from the colony. In this study we aimed to quantify the ambient exposure experienced by each monkey during different developmental periods of their lives. We calculated cumulative PM2.5 and O3, maximum PM2.5 exposure, and days over the NAASQ dictated safety indexes for PM2.5 and O3. We found that infants born in 2008 were exposed to significantly higher levels of PM2.5 than those born in 2009. To better understand the impacts of WFS on long-term health, we will use this data to correlate developmental WFS exposure with immune parameters and pulmonary function measurements.

| Nina Han |

Major: Animal Science
Mentor: Eva Schepeler
Research Type: UHP Project

University Honors Program Mental Health Initiative

The state of mental health among college students is an issue that has been thoroughly studied in recent years after increased public awareness. What is lacking, however, is research specifically on honors students' mental health, which we suspect is uniquely at risk because of the high expectations to succeed placed on them by themselves and others. This study aims to shed light on this issue by administering a survey to students in the University Honors Program (UHP) at UC Davis asking students about their UHP experiences, their mental state, and their knowledge of campus mental health resources. The preliminary results of this investigation suggest that honors students are stressed about honors classes, lack of support from UHP staff, and program requirements (i.e. GPA). The ultimate results of this survey will be used to produce a series of mental health workshops for honors students and will provide insight to UHP staff on how to best support students in UHP. Overall, these results will serve as a starting point for shifting the culture surrounding mental health in honors students, so that future UHP students will be better prepared to manage their stress and consistently prioritize their mental health.

| Nicole Hensley |

Major: Biotechnology
Mentor: Abhaya Dandekar
Research Type: Thesis in Major

The Production of Phospholipase A2 (PLA2) Neutralizing Proteins in Walnut Embryos to Fight Inflammation

The South American snake, Bothrops jararacussu, secretes venom into its victim causing the amplification of PLA2 activity. PLA2 removes fatty acid from phospholipids, which results in inflammation. Humans who are bitten are treated with antivenom that their body will accept. Many antivenoms have been produced in large animals. However, after a human is given the antibodies produced by these animals for a third time, and after them, the antivenom has no effect. The venom of the snake contains toxin neutralizing proteins that prevent PLA2-caused inflammation and effectively make the snake resistant to its own venom. These proteins have been extracted from the blood of venomous snakes, and synthesized in model organisms, such as tobacco plants. Walnut embryos are a new factory for these proteins; they are smaller than tobacco plants and produce copious amounts of protein that are easy to detect and isolate. This research experiment is determining the difference in protein production in walnut embryos transformed with a plasmid containing His or FC-tagged sequences of the anti-inflammatory protein. The proteins can eventually be utilized to help prevent inflammation due to the snake bites, or even help humans fight inflammation in the formation of cancerous tumors.

| Erin Hisey |

Major: Animal Science
Mentor: Rebecca Bellone
Research Type: Thesis in Major

Genome Wide Association Study Identifies Two Loci for Distichiasis in Friesian Horses

Distichiasis, a condition reported in Friesian horses, occurs when lashes grow from the Meibomian glands along the inner eyelid. These lashes can cause irritation and corneal ulcers, which can lead to vision loss or eye removal. Because of its bilateral nature and prevalence in a breed with known monogenic disorders, this condition is hypothesized to be inherited as a Mendelian trait. To test this, a genome wide association study (GWAS) was performed utilizing the Equine Affymetrix 670K array (MNEc670k) on fourteen cases and thirty-eight controls phenotyped for distichiasis. A chi-squared test for a basic allelic association identified a 1.83 Mb locus on ECA5 and a 371 kb locus on ECA13 as associated with the disorder (pcorrected=0.025 and 1.5x10-4, respectively), however genomic inflation was high (λ=1.50). To correct this, a single locus mixed linear model (EMMAX) was employed. In an additive model, both loci were further supported (pcorrected=0.016 and 0.032, respectively). A haplotype analysis (hapQTL) narrowed the region of association on ECA5 to 235 kb and on ECA13 to 163 kb. Whole genome high-throughput sequencing data from 3 cases and 2 controls is being analyzed in the associated regions to identify variants that explain the genetic risk for distichiasis.

Tanya Hsiung

Major: Nutrition Science

Mentor: Bo Lonnerdal

Research Type: Type: UHP Thesis

MiR-22 Promotes Intestinal Proliferation by Attenuating Expression of the C/EBPδ Gene

MicroRNAs function in RNA silencing, which has downstream effects on protein expression. Previous studies on human milk have shown a high concentration of microRNA-22 (miR-22), and that miR-22 is resistant to in-vitro digestion under conditions mimicking those of the human infant gut. We, therefore, hypothesized that miR-22 plays an important role in intestinal development. To determine effects of miR-22 on the intestine, human intestinal epithelial cells (HIEC cells) were transfected with miR-22 and microarray assays were conducted. Based on the results, miR-22 contributes to cellular proliferation, and the C/EBPδ gene may be a direct target as there is a potential binding site for miR-22 in the 3' untranslated region of the C/EBPδ gene. Furthermore, C/EBPδ RNA and protein levels were significantly attenuated by miR-22. C/EBPδ is a transcription factor and is involved in a wide range of biological activities, including cellular proliferation. To evaluate effects of C/EBPδ on cellular proliferation, HIEC cells were transfected with C/EBPδ siRNA. After expression of C/EBPδ was inhibited by ~ 70%, cellular proliferation dramatically decreased. In summary, miR-22 stimulates intestinal proliferation by inhibiting expression of the C/EBPδ gene.

Emma Maloney

Major: Managerial Economics

Mentor: Jim Chalfant

Research Type: Thesis in Major

The Economic Advantages of a Multilingual Workforce: Cognitive, Personal, Academic, Social, and Global Benefits Associated with the Wage Premium

The highly monolingual American workforce is at a significant disadvantage when compared to the multilingual workforce in countries across the world, particularly in global business. Through the analysis of data sets and a variety of socio-economic benefits, as well as research on wage premiums, this thesis will quantify the benefits of multilingualism that economists seek to understand. A clear wage premium exists for multilingual individuals, even if they do not use multiple languages in their careers, suggesting that being bilingual could be capturing other individual characteristics desirable in the workforce. However, the benefits are not limited to this wage premium; they range from cognitive, personal, academic, social, and global benefits. While the data sets explore various research questions, all support my thesis which states that learning a second language is extremely beneficial and that the United States should advocate for multilingualism in schools. I have illustrated the research findings and analysis in such a way that emphasizes these benefits. With the positive results obtained in this thesis, suggestions can be made for policy changes in schools to provide for additional education in a second language and help encourage individuals to strive towards a multilingual workforce.

Amanda Lee

Major: Human Development

Mentor: Johnna Swartz

Research Type: UHP Thesis

Emotion Regulation: Parental Influence on Children's Development of Emotional Regulation Skills

Emotion regulation, the ability to recognize and respond to one's emotions in a socially acceptable way, is a critical aspect in child development, as children with better emotion regulation skills have better prosocial behavior and can cope better or recover quickly when faced with stressful situations. The purpose of this study is to research parental influence on child's emotion regulation skills. In particular, this study will be looking into parental use of modeling and of parental engagement in emotion socialization with their child. In a sample of 50 participants, parents completed an online survey targeted to analyze the parent's emotion regulation skills as well as of their child between the ages of five to eleven. There was a lack of statistically significant main effects of parental use of reappraisal and of parental engagement in emotion coaching on child emotion regulation skills. However, there was a marginally significant interaction between parental use of emotion coaching and child age such that parents reported emotion coaching having a stronger, positive effect on younger children's emotion regulation skills and a negative effect on older children's emotion regulation skills. This study also took into consideration parental attitudes towards their child's displays of emotion and how these attitudes may affect their child's emotion regulation skills. Results of this study found a statistically significant negative correlation between parent's feelings of ineffectiveness and child emotion regulation abilities, but no statistically significant correlation between parent's use of cognitive suppression and child emotion regulation skills. In conclusion, child age may have a factor in parental attitudes towards displays of emotion, which may subsequently have an effect on the development of a child's emotion regulation skills.

Kyle McNeil

Major: Environmental Science & Management

Mentor: Daniele Zaccaria

Research Type: Thesis in Major

Spatio-temporal Assessment of Water Demand of Pistachio Orchards Grown with Micro-irrigation on Non-saline and Increasingly Saline Soils in the San Joaquin Valley of California

California grows more than 98% of all pistachios produced in the US and feeds a multi-billion dollar industry with increasing acreage every year. With the passage of the Sustainable Groundwater Management Act (SGMA) in 2014, future groundwater extractions for agricultural users will be limited to sustainable levels in an effort to halt overdraft of groundwater basins. Thus, there is a need to develop reliable time-distributed information on water demand for pistachio production at various spatial scales. In this study we aim to derive a water demand hydrograph across the pistachio growing season for detailed analysis units (DAU) using the Cal-SIMETAW model. The model uses soil type, crop coefficients, rooting depths, and climate information to calculate the evapotranspiration of applied water (ETAW). The results of the proposed analysis will provide a valuable knowledge base on time-distributed irrigation demand for pistachios and help inform water resources planning, allocation, and management decisions.

Izaac Ornelas

Major: Managerial Economics
Mentor: Edward Taylor
Research Type: Thesis in Major

Who Chooses Agriculture? Meeting the Demand for a Skilled Agricultural Workforce

Are there enough people going into agriculture occupations to meet future food demands of a growing population? Preliminary analysis using the American Community Survey (ACS) has shown since 2009 a negative trend of those receiving degrees in agriculture. The purpose of this study is to understand if individuals who are getting agricultural degrees end up in agricultural occupations. Further investigation using a probit regression model display the effect of having an agriculture degree on the probability of agricultural employment is decreasing over time; but everything else constant the probability of employment is not decreasing over time. This might be the result of a growing agricultural industry that is relying more on technology and other skills usually found in urban industries. Otherwise, those who have higher educational attainment beyond high school— as well as being female— have been predicted to have a lower probability of working in agriculture. Moreover, living and being born in certain states seem to have an effect on this probability but differ depending on the area. This may signify a demand for higher education institutions to experiment with tactics to draw more students into agricultural degrees to resolve issues in agriculture.

Elise Pohlhammer

Major: Human Development
Mentor: Adrienne Nishina
Research Type: UHP Thesis

Should Multiethnic Adolescents Be Considered their Own Ethnic Group?

Multiethnic individuals (belonging to two or more ethnic groups) are projected to exceed 11% of the US population by 2060. To better understand how researchers can categorize such individuals by ethnicity, this study: (1) compared multiethnic adolescents to all other monoethnic adolescents and (2) examined them as a freestanding ethnic group similar to traditional groups (e.g White, Latinx). Tenth-graders in California and Oregon (N = 590; 50% male; 6.6% African-American, 16.9% Asian-American/Pacific Islander, 30.9% White, 25.6% Latinx, 17.5% Multiethnic) were surveyed on openness to cross-ethnic friendships and the centrality of ethnicity to one's overall identity. ANOVA results suggest that multiethnic adolescents do not differ from monoethnic adolescents overall in ethnic centrality. However, when multiethnicity was treated as its own ethnic group, multiethnic adolescents, along with ethnic minority adolescents, had higher centrality than White youth; this may suggest that multiethnic adolescents view themselves collectively as a group. Additionally, multiethnic adolescents were more open to cross-ethnic friendships than monoethnic adolescents, a difference driven by the multiethnic adolescents reporting more openness specifically than Latinx adolescents. These findings suggest that multiethnicity might be best considered an ethnic group and that greater openness to diverse friendships may be a positive aspect of multiethnic identity.

Brenda Ruiz Anaya

Major: Animal Science
Mentor: Anna Denicol
Research Type: UHP Thesis

Investigation of Aromatase Expression in Bovine Preantral Ovarian Follicles

Follicle stimulating hormone (FSH) has a critical role in development of preovulatory ovarian follicles, but little is known about its possible roles in early (preantral) follicles during primary and secondary stages of development. Current research from our laboratory shows that bovine preantral follicles express receptors for FSH (FSHR) as early as the primary stage of development. One of the roles of FSH in preovulatory follicles is to stimulate aromatase, the enzyme responsible for conversion of androgens to estrogens. Our hypothesis is that the FSHR found in preantral follicles is active, and binding of FSH elicits downstream signaling including increased expression of aromatase. Our objective is to evaluate whether expression of aromatase increases in response to FSH signaling in preantral follicles. To accomplish this, we will perform immunolocalization of aromatase in histological sections of bovine ovarian cortex exposed to FSH in-vitro for 2 days; controls will be sections of ovarian tissue exposed to a vehicle control. We are currently optimizing the protocol for cryosectioning ovarian tissue and will next start optimizing the immunostaining protocol using an antibody known to react with bovine aromatase. These results will be important to improve our understanding of FSH in regulating ovarian follicle development.

Selena Silva

Major: Community and Regional Development
Mentor: Martin Kenney
Research Type: Thesis in Major

Female Representation in Executive Management and Board Positions in Emerging Growth Initial Public Offerings

Companies with more equal levels of gender representation tend to have stronger short-term performance and higher levels of innovation compared to male-dominated firms. However, female representation in executive management and board positions remains quite low. This research provides an up-to-date descriptive analysis of gender representations in all firms that went public from 1990 to 2015 using Kenney & Patton's Emerging Growth IPO Management and Director Database. Roughly one half of firms did not include any woman executive at the time of their IPO. Despite this, the number of women involved increases over time indicating more equal representation over generational shifts. These women most commonly occupy vice president and director positions. When we examine industry, women have the largest percentage of representation in retail trade, services, and finance. However, when we compare the women involved in the IPO, we see that most are in the manufacturing and services industry. Having a woman in a position of power does not appear to be related to the hiring of additional women in other management roles or board positions. Detailed data describing gender dynamics can motivate firms to address gender disparities and contribute to increased female representation in positions of power.

Jason Robert Singson

Major: Global Disease Biology
Mentor: Karen Shapiro
Research Type: Type: Thesis in Major

Establishing Functional and Accessible Field Epidemiological Capacities at the Local Public Health Level: A Case Study on a Multischool Norovirus Outbreak in Yolo County

A countywide outbreak of norovirus impacted nearly 4,000 students across Yolo County's school districts from late April to mid-June of 2017. Public health measures focused on controlling norovirus transmission by excluding and isolating patients, conducting proper environmental disinfection, and promoting proper hand hygiene. However, these measures proved difficult to implement during the outbreak due to the norovirus strain's emergent nature and the county's large geographic region. An 11-year literature review (2008-2018) identified 303 articles for literature documenting past norovirus outbreak investigations. Nine relevant articles were included in the present review due to the use of descriptive and analytical epidemiology in outbreak investigations involving K-12 schools. The findings of past outbreak investigations will inform a critical analysis of the outbreak investigation in Yolo County. Since norovirus is not usually a disease with mandated reporting, outbreak investigation articles were difficult to find. The implications of this study provide insight into how smaller local health departments respond to outbreaks, shifting to a more focused and active approach involving proactive public health surveillance and intervention.

Tahmina Tasmim

Major: Animal Biology
Mentor: Jonathan Dear
Research Type: Thesis in Major

Dogs and Demographics: Neuter Status and Vaccine History in Canine Patients from Underserved Communities

Veterinary care is an important aspect of animal welfare and pet ownership. However, not all pet owners have access to veterinary care or utilize certain resources. There is a lack of research on health issues in pets from underserved communities, which puts veterinary professionals at a disadvantage to serve them. This study examines whether dogs in medically underserved communities and dogs from well-served communities have differences in health status and population dynamics. We will compare data from patient files of dogs examined at a no-cost wellness clinic servicing a low-income rural community to dogs examined at a private practice clinic in a suburban setting. We hypothesize that the most significant differences between the two demographics will be in neuter status and vaccination record. We expect dogs from the underserved community to be less likely to be neutered, and less likely to be up to date on vaccines. These findings can potentially be used to improve resource allocation at the Knights Landing One Health Veterinary Clinic (KLOHC), a no-cost clinic hosted by the veterinary school at the University of California, Davis, or other clinics serving similarly underserved communities.

Melissa Thurston

Major: Animal Science
Mentor: Cassandra Tucker
Research Type: UHP Thesis

Dairy Cattle use of Areas Within Their Housing is Based on More than Just Microclimate

Behavior of dairy cattle can be influenced by factors such as temperature, stocking density, feeding schedule, and more. How cows alter their behavior in response to specific microclimates within a particular area of their home environment is not yet understood. Our objective was to assess variation in microclimate of the feeding and lying areas, the usage of these areas by lactating dairy cows, and if a relationship exists among the two variables. Sensors collected temperatures within the feeding and lying areas while 24-hour video surveillance was used to record cow position and determine housing area usage. Mixed models were used to evaluate variation in temperature and cow use of the lying and feeding areas. We expected cows to spend more time in the cooler areas of their environment, however, even though variation in temperature and housing area usage were present, cows did not use these areas more than warmer ones. Variables other than or in addition to microclimate temperature likely influenced the differences seen in how cows use their environment and this merits further research.

Sarah Vegliante

Major: Clinical Nutrition
Mentor: Carolyn Thomas
Research Type: UHP Thesis

Social Media and Eating Disorders

This study asks the question 'What impact does social media have on eating disorders? This is important because social media may change the way students eat and perceive their bodies. This study engaged UC Davis students with disordered eating using Qualtrics, using a mixture of multiple-choice questions and written answers. Two themes recurred in the questionnaire: 1) how social media influences body perception and 2) the influence of social media and a person's eating behaviors. I hypothesize that just one hour of social media use per day will increase the likelihood that students will have distorted perceptions of their bodies and irregular eating behaviors. This would be an important finding for UC Davis students. When I present my research, students who attend will have the opportunity to think about their own social media use, how it has affected them and be able to make the choice to cut back on their social media use. Also, this would be an important finding for the students who are part of the Body Project. The students who participate in this survey will now have a better understanding of how social media impacts their perception of their bodies or their eating behaviors.

Catherine Williams

Major: Global Disease Biology
Mentor: Johan Leveau
Research Type: Thesis in Major

Identification of an Additional Antifungal Compound Produced by Collimonas arenae Cal35

Many fungal plant pathogens can infect and destroy crop plants, posing a risk to food security and the agricultural industry. Given concerns about traditional fungicides, research into alternative modes of pathogen management, such as biocontrol, has become important. Some bacteria are known to possess the ability to inhibit fungal growth. These include members of the bacterial genus Collimonas. In particular, strain Collimonas arenae Cal35 has antifungal activity against multiple fungal plant pathogens, and the Leveau lab has several leads on the genes that underlie this activity. It was observed that inactivation of these genes decimated Cal35's production of a potential antifungal compound that inhibited all tested fungi with the exception of Magnaporthe grisea, the causative agent of rice blast disease. Since these mutants that could not produce this compound still inhibited M. grisea, I hypothesize that Cal35 harbors an additional gene locus imparting activity against M. grisea. This hypothesis is tested by screening a Cal35 transposon library for mutants that have lost antifungal activity against M. grisea, and identifying the transposon insertion site in such mutants. This project will contribute to our understanding of antifungal activity by Collimonas, which may help in the development of novel biocontrol applications for agriculture.

Seiji Yokota

Major: Entomology
Mentor: Carolson Arnett
Research Type: UHP Project

Christoff Rösener's *Honorable Compliments and Praises of the Knightly Free Art of the Fencer and the Brotherhood of St. Mark*

The aim of this project is to translate into modern English and make freely accessible online Christoff Rösener's fencing book, Ehren Tittel und Lobspruch der Ritterlichen Freyen Kunst der Fechter (1589). Christoff Rösener was a member and sword-master of the Brotherhood of St. Mark (Marxbrüder), the preeminent fencing guild of the Holy Roman Empire that operated from 1487 through the 17th century. Translating this book is important because no modern English translation has been made, restricting access to German speakers and scholars. Texts such as these are primary sources for European fencing history and are our only links to understanding the praxis and theory of historical fencing traditions. I used a transcription by fencing historian Karl Wassmandorff (1821-1906) to translate Rösener's book using a combination of Early New High German, Middle High German, and Latin dictionaries, assistance from my supervising Professor, and my own German literacy. Translation has revealed that the text includes an extensive contemporary history of fencing extending back to Antiquity, a list of the techniques and of Marxbrüder's fencing, a commentary of the knightly qualities requisite of any fencer, and a fictional narrative detailing the Marxbrüder's Fencing Master examination.

Sierra Winter

Major: Environmental Sciences and Management
Mentor: Deb Niemeier
Research Type: Thesis in Major

Environmental Justice with Regards to the Camp Fire

Due to climate change increasing the intensity of natural disasters, wildfires have had an unprecedented impact on California in the past years. The Camp Fire, the deadliest and largest fire in California history, killed 86 civilians and burned over 150,000 acres, burning down close to all of the buildings in the Town of Paradise in Butte County. In an effort to better understand the effects of this tragedy, I will research whether minority demographics experienced a higher evacuation rate, as this could mean that fire-fighting efforts were focused on higher-income neighborhoods or that the fire was diverted away from such neighborhoods towards lower-income areas. An extensive survey collected information regarding evacuees' life histories, demographics, home insurance, knowledge of current events regarding the fires, future plans, and their entire warning and evacuation processes. I will analyze the data by looking for correlations between home address densities of evacuees (i.e. where they evacuated from) in regards to demographic data about median household incomes, median house values, and poverty rates provided about specific zip codes in Butte County by the US Census.

College of Biological Sciences

| Rida Ali |

Major: Neurobiology, Physiology, and Behavior
Mentor: Dave Segal
Research Type: UHP Thesis

Delivery of Recombinant Proteins Across the Placental Barrier for Angelman Syndrome

Angelman Syndrome (AS) is a rare genetic disorder that impacts the nervous system of 1 in 12,000-20,000 individuals. It is characterized by delayed development, intellectual disability, and severe speech impairment. Most affected children suffer from epilepsy and microcephaly. AS is caused by the loss of function of the gene for Ubiquitin-protein ligase E3A (Ube3a) , which plays a pivotal role in protein degradation..

| Riya Bansal |

Major: Neurobiology, Physiology, and Behavior
Mentor: Marina Crowder
Research Type: UHP Project

Student-Facilitated Course on Writing Books for Pediatric Patients in Underserved Healthcare Communities

Oftentimes, there is a lack of reading material in the waiting rooms at clinics and children's hospitals; this is especially true for healthcare facilities in low-income communities both locally and abroad. In order to engage students in creating books for children in these communities, we designed a first year seminar (FYS) entitled "Writing for Wellness: Creating Children's Books to Support Pediatric Patients in Underserved Communities". The main objectives of the course were to practice incorporating empowering messages within stories written for a younger audience and discussing the impact of how socioeconomic disparities found in low-income communities hinder children's psychological and academic growth. Combining our knowledge of, and experience in writing books for pediatric patients and working in low-income healthcare communities both locally and abroad, we designed weekly lectures, reading and writing assignments, discussion questions, and in-class activities that encompassed these themes. Importantly, we designed a final project that resulted in students writing and illustrating original story books with positive messages, to be printed and distributed to low-income communities locally and abroad for children in these communities to read and enjoy.

| Sarah Basharkhah |

Major: Neurobiology, Physiology, and Behavior
Mentor: Johnna Swartz
Research Type: Thesis in Major

The Association Between Neural Activity to Food and Socioeconomic Status

Rising obesity rates signal a public health concern in the United States. Previous studies demonstrated a link between low socioeconomic status (SES) and obesity, which could be explained in part by associations between SES and behaviors related to delay of gratification (DG), the process of declining a short-term reward for a better, long-term outcome. The goal of the current study was to test the hypothesis that SES is related to neural activity to food within regions related to DG, including the nucleus accumbens and orbitofrontal cortex. Data from the Adolescent Health and Brain study was used to test this hypothesis. Adolescent participants completed a food viewing task during a functional Magnetic Resonance Imaging (fMRI) scan. Adolescents and their parents also completed self-report measures, including parent education level to measure SES. Initial analysis of the fMRI data indicated that responses to food occurred in regions separate from those chosen a priori. Results from this research have implications for understanding how DG may relate to food preferences and obesity risk.

| Joleen Cheah |

Major: Biological Sciences
Mentor: Soichiro Yamada
Research Type: Thesis in Major

Force-induced Recruitment of LIM Domain Containing Proteins

Physical force emerged as a mechanical cue for regulation of cell migration, division, and differentiation. Yet, we know very little about how physical signals translate into chemical signals that alter cellular processes. Zyxin, a LIM domain containing protein, accumulates along force-bearing actin fibers, and the LIM domains of zyxin are solely responsible for this force-induced relocalization. The LIM domain is found in many proteins with diverse sequences and functions. However, the force-sensitivity of LIM domain containing proteins has not been explored in detail. Here, we screened 18 different LIM proteins across the 14 classes in the protein family using a microneedle to mechanically stimulate cells expressing fluorescently-tagged LIM proteins. Prior to stretch, these LIM proteins localized to the cytoplasm, focal adhesions, nucleus, and actin fibers, though pre-stretch localization was not a predictor of force-sensitivity. When stretched, only the proteins with multiple LIM domains accumulated to actin fibers or focal adhesions or both, suggesting that a single LIM domain is not sufficient for force-sensitivity. Given the diversity of the LIM proteins, understanding the mechanosensory properties of their LIM domains will generate a broader understanding of how physical forces impact cell signaling and cellular responses.

Jenny Chen

Major: Cell Biology
Mentor: Francis McNally
Research Type: Thesis in Major

HMA: A New Drug for Treating Cancer

Breast cancer is one of the most prevalent forms of cancer in US women. Nearly 30% of women diagnosed with breast cancer eventually develop recurrent disease in metastatic sites. Most primary breast tumors are molecularly and genetically diverse. This makes it very difficult to treat tumors, as each cell responds differently to treatments. Typical chemotherapeutics aim to disrupt the cell cycle by inhibiting mitosis, which causes severe damage to the cell, inducing apoptosis. However, a major challenge in cancer therapy is that some of the cancer cells become apoptosis resistant, leading to therapeutic failure. To help eradicate these apoptosis resistant cells, I present hexamethylene amiloride (HMA) as a promising new anticancer therapeutic. Through initial experiments, we have discovered that HMA does not affect normal breast cells, leaving them at almost 100% viability compared to the breast cancer cell lines, which are reduced to around 40% viability at 40 uM of HMA. Based on our in-vitro assays, HMA can slow or reduce the growth of tumors compared to our control mice. If HMA is indeed a viable anticancer therapeutic that can effectively wipe out the apoptosis resistant cancer populations in tumors, we may be able to decrease cancer recurrence.

Stephen DaRodda

Major: Microbiology
Mentor: Bryce Falk
Research Type: Thesis in Major

Carrot mottle virus as a Viral Vector to Express GFP in Plants

An important part of maintaining healthy crops is protecting them from insects that transmit pathogens. While transgenic plants can be made that are harmful to insects such, as Bt Corn, that solution is not always desirable. An alternative to creating transgenic plants is using a virus as a vector to express proteins and peptides, which are selectively toxic to specific insects, in plants. This project is concerned with creating an infectious, transgenic clone of Carrot mottle virus (CMoV) that is capable of expressing proteins of interest in plants. CMoV is a positive sense single stranded RNA (+ssRNA) virus in the family Tombusviridae and can be found in California. In order to have the proteins of interest expressed in plants, the corresponding genes must first be inserted into the genome of CMoV. However, because CMoV has not been used as vector before, the method of successfully inserting genes must be determined. Green fluorescent protein (GFP) is an ideal protein to test for possible insertion sites and strategies because of its ease of detection as a marker. Repeatable systemic infection of the transgenic CMoV with GFP expression throughout the plant is indicative that CMoV has successfully been converted into a viral vector.

Sofia Donovan

Major: Biological Sciences
Mentor: Aliki Dragona
Research Type: UHP Project

Challenges to Implementation of Global Health Principles: A Review and Reflection

According to the World Bank, at least half of the global population cannot obtain essential health services, and nearly 100 million people are pushed into poverty due to health expenses each year (2017). Global health has become a widely recognized and researched problem in recent decades, but non-profit professionals and volunteers will undoubtedly face many obstacles when addressing the health needs of developing countries internationally. These challenges may present themselves internally in the aiding organization or externally in an international setting. Understanding the nature of these difficulties is imperative to effective health aid, as one must be able to anticipate and properly respond to them. This project discusses common challenges that arise during implementation of global health humanitarian projects in the context of four major categories identified in a 2017 study by Weiss and Pollack: (1) Resource Limitations, (2) Priority Selection, (3) Corruption and Lack of Competence, and (4) Social and Cultural Barriers. With understanding of these challenges, health humanitarians will be better-equipped to tackle health inequity and work toward global universal health care.

Tia Dunbar

Major: Biological Sciences
Mentor: Abhaya Dandekar
Research Type: Thesis in Major

Effects of Increased Polyphenol Oxidase Activity on Infection by Pratylenchus vulnus in Walnut Roots

Nematodes are among the most abundant animals on Earth. Consequently, pathogenic soil nematodes play a serious role in the destruction of crops due to their sheer numbers. The root-lesion nematode Pratylenchus vulnus is a prolific soil pathogen that parasitises over half of California's top agricultural crops, including walnuts. P. vulnus feeds on the intracellular contents of plant roots and kills its host after inflicting sufficient damage. Nematicides that have been used in the past can eliminate soil-borne nematodes but are often environmentally unfriendly, economically unfeasible, and harmful to beneficial soil organisms. This project aims to contribute to more practical approaches to protecting walnut crops from P. vulnus by enhancing the plant's natural immune response. Two genes of interest, jrPPO1 and jrPPO2, are known to promote activity of polyphenolic compounds in walnuts. Polyphenol oxidases (PPOs) are enzymes that function in many plant species as a wound response and inhibit bacterial infection. We have engineered walnuts to constitutively express jrPPO1 and jrPPO2 in an effort to increase resistance to root-lesion nematodes. Our experiment monitors the effects of jrPPO1 and jrPPO2 upregulation on walnut root infection by P. vulnus.

| Elyn Dushane |

Major: Biological Sciences
Mentor: Annie King
Research Type: Thesis in Major

Lipid Oxidation in Meat from Boilers Feed Organic Diets with Cowpeas and Sunflower Meal

The objective of this study was to compare lipid oxidation rates in variously processed thigh meat from broilers (meat-type chicken) fed organic cowpeas (no added methionine) in place of traditional corn and soy with added synthetic methionine. All broilers, raised to 6 weeks of age, were provided diets specialized for their growth level. Treatment included a control corn/soybean meal, Basal formulation (D1); Basal + 20% Sunflower Meal (D2); Basal + 20% unheated Cowpeas (D3); Basal + 20% Sunflower Meal; Basal + 20% unheated Cowpeas with no added methionine (D4); and Basal + 20% Sunflower Meal and 20% heated Cowpeas with no added methionine (D5). At processing, thigh samples from birds fed each diet were collected and frozen in liquid nitrogen before being stored in a -80°C freezer. Samples were processed into 6 conditions of raw; raw in the refrigerator for 3 days; raw in the freezer for 2 weeks; cooked; cooked, stored in the refrigerator for 3 days; and cooked, stored in the freezer for 2 weeks. Lipid oxidation was determined with the thiobarbituric acid assay. We hypothesized that D4 and D5, diets with no synthetically added methionine, would show higher oxidation rates in the raw and cooked samples.

| Nadejda Godoroja |

Major: Biochemistry and Molecular Biology
Mentor: Karen Ryan
Research Type: Thesis in Major

Hypothalamic β-klotho Controls Energy and Glucose Homeostasis in Mice

Obesity is a worldwide health problem that requires major attention in many countries. Fibroblast growth factor 21 (FGF21) is a hormone known to improve glucose homeostasis and decrease body weight when administered to obese mice. FGF21 crosses the blood–brain barrier and its action on the brain has been shown necessary for the hormone's weight loss effects. The precise brain region/s where FGF21 acts is unknown; however, previous research suggests that the paraventricular nucleus (PVN) of the hypothalamus plays an essential role in controlling energy and glucose homeostasis. To test whether the PVN is necessary for the observed FGF21 metabolic effects, β-klotho, an obligate co-receptor for FGF21, was silenced specifically in the PVN using AAV-mediated viral knockdown. The resulting metabolic effects were analyzed using glucose tolerance tests, body composition analysis, and feed intake during two phases: chow and high-fat diet (HFD) consumption. Reducing β-klotho in the PVN resulted in weight gain and poor glucose homeostasis, supporting a role for endogenous FGF21 signaling in the PVN to control systemic metabolism. These findings identify the PVN as a potential target for treating obesity and diabetis. Future studies will determine the role of PVN β-klotho to mediate the effects of pharmacological FGF21 treatment.

| Bryan Heng |

Major: Biological Sciences
Mentor: Hwai-Jong Cheng
Research Type: Thesis in Major

Origin and Laminar Distribution of Newborn Granule Cells in Adult Hippocampal Neurogenesis

Adult hippocampal neurogenesis (AHN) is a form of neural plasticity where new neurons are integrated into pre-existing brain circuits. Current research on AHN has focused on young adult ages – few studies have examined older adult ages. This project examined the origin and migratory pattern of adult-born neurons in the hippocampus by looking at AHN throughout the lifespan of mice. We hypothesized that the pattern of adult-born granule cell distribution would recapitulate their distribution during neonatal development. We predicted that this recapitulation would result in the distribution of granule cells throughout the granule cell layer of the dentate gyrus. This project utilized the CreER recombinase / tdTomato system to determine the number and localization of granule cells in aged animals at different timepoints after their birth. Contrary to our hypothesis, we found that adult-born granule cells were primarily localized within the inner region of the granule cell layer. Our analysis also revealed that the number of adult-born granule cells peaked between three and six months of age. These results suggest that AHN impacts a specific subset of granule cells localized in the inner core of the dentate gyrus and that these adult-born granule cells are generated from a specific neurogenic niche.

| Catherine Hou |

Major: Neurbiology, Physiology, and Behavior
Mentor: Nicholas Marsh-Armstrong
Research Type: Thesis in Major

Severed Axons and Extracellular Debris in the Optic Nerve Head at Very Early Stages of Non-human Primate Experimental Glaucoma

This experiment studied severed axons within the optic nerve head (ONH) in Non-Human Primate (NHP) Early Experimental Glaucoma (EG) to determine whether there is a relationship between electrolucent extracellular structures and the location of axon ends. Two serial block-face scanning electron microcopy (SBEM) volumes of the ONH obtained from a NHP early in degeneration were compared to axons in a second control nerve. Approximately 1140 (1%) axons were randomly chosen on the vitreal side of the blocks and traced to establish their continuity. The eleven axons that ended within the block were from animals whose eyes were subjected to EG. They were found both in unmyelinated and myelinated portions of axons, often associated with phagocytic cells and/or large pockets of extracellular electrolucent material, and several turn sharply near their ends. Reconstructions of nearby electrolucent extracellular material do not match any known structure. The mean distance of axon ends to the nearest electrolucent pocket was not significantly different from distances from random points within the same blocks to the nearest electrolucent pocket. Axons that contact the severed axons or pockets of extracellular material will be traced and compared to randomly selected control axons to determine significant deviations attributable to glaucomatous degeneration.

| Willa Aline Ingelson-Filpula |

Major: Biochemistry and Molecular Biology
Mentor: Neil Hunter
Research Type: Thesis in Major

Absence of Breast Cancer Associated Factor BRCA2 Impacts Ovarian Follicle Development in Mice

Homologous recombination is an error-free DNA double-strand break (DSB) repair pathway required for both germ and somatic cells to maintain the genomic integrity. BRCA2 mediates the assembly of RAD51 onto DSB ends in somatic cells, thus catalyzing the pairing and exchange of DNA strands for successful repair. This study aims to further our understanding of BRCA2 function during meiotic recombination, specifically during reproductive development – the production of ovarian follicles in the female germline. Brca2 is an essential gene which is embryonically lethal when knocked out, therefore we crossed a line carrying a conditional flox'd allele of the Brca2 gene with a mouse line expressing Cre recombinase under a meiosis-specific promoter (Spo11-Cre) to form a conditional knockout mouse model. This mouse model allowed us to deactivate Brca2 exclusively in meiotic cells. To understand the role of BRCA2 at distinct stages of reproductive development, ovaries from postnatal day 1, 4, and 63 of Brca2 flox'd and age matched controls were sectioned and immunostained to analyze for defects in oocyte formation and development. Brca2 mutants showed a significant decrease in follicle number compared to controls at postnatal days 1, 4, and 63. This data suggests a key role for BRCA2 during follicle development. However, to further understand the loss of ovarian follicles in Brca2 mutants, we are currently investigating the follicle counts and meiotic stages in embryonic ovaries.

| Celena Lozano |

Major: Neurobiology, Physiology, and Behavior
Mentor: Aldrin Gomes
Research Type: UHP Thesis

Antioxidant Activity in Brains from Ibuprofen-Treated Mice

More than 30 million people use Non-Steroidal Anti-Inflammatory Drugs (NSAIDs) daily to treat pain, fever, and headaches. The common NSAID diclofenac has been linked to increased risk of cardiovascular disease by induced proteasome dysfunction. It has been suggested that disruption of the ubiquitin proteasome system (UPS) may play a role in neurodegenerative diseases such as Alzheimer's Disease. My preliminary data has provided evidence for decreased proteasome activity in the brain tissue of male mice treated with ibuprofen for seven days. I hypothesized that increased levels of reactive oxygen species (ROS) and/or decreased antioxidant activity is responsible for neuronal proteasome dysfunction. To test this hypothesis, I cultured neurons in their favorable growth conditions and treated them with 200 mM ibuprofen for one to seven days. Both prior to treatment and after treatment, I measured the relative enzymatic activity of three antioxidants commonly found in the brain: superoxide dismutase, glutathione reductase and glutathione peroxidase. I did the same measurement in the brain tissue of mice treated both with and without 100 mg/kg/day of ibuprofen for seven days. I expect to find a difference in the antioxidant activity of neurons and brain tissue treated with and without ibuprofen.

| Jennifer La |

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

Environmental Pollution and Systemic Inflammation in Children Residing in Greater Sacramento

Children's health is often linked to the environment in which they grow up. Previous research has found that environmental pollutants contribute towards markers of systemic inflammation in adults, posing numerous health risks. In order to examine if this positive relation between environmental pollutants and systemic inflammation can be found in children, we measured children's inflammation through circulating levels of Interleukin-6, Interleukin-8, and TNF-a in their blood samples obtained from our Social Support Study. We recruited 100 healthy children aged 9 or 10 from the Greater Sacramento area to participate in the study, which included obtaining two blood samples before and after a public speaking task. We will examine daily air quality index (AQI) and average PM 2.5 levels from the United States Environmental Protection Agency's database. Through this study, we predict that children who reside in locations with a higher AQI on the day of each session and higher average PM 2.5 levels will have greater markers of systemic inflammation compared to those from locations with fewer environmental pollutants. This study may help identify early-life risk factors for poor physical health and suggest programs to buffer children from future environmental-linked diseases stemming from systemic inflammation.

| Emily Meyers |

Major: Evolution, Ecology, and Biodiversity
Mentor: Jay Stachowicz
Research Type: Thesis in Major

Effects of the Marine Macroalga Ulva sp. on the Microhabitat Distribution of Mesograzers in Eelgrass (Zostera marina) Beds in Bodega Bay, CA (USA)

Seagrasses comprise highly productive habitats that support many marine animals, including mesograzers (invertebrate grazers). The effects of mesograzers on seagrass are species-specific, making the consequences of community alterations in these systems complex and often unpredictable. As global seagrass area has declined, understanding the species-specific interactions between seagrass and mesograzers has become increasingly important, yet these interactions remain poorly understood. Both predatory fish and blooms of the macroalga Ulva sp. may influence the distribution of mesograzers in eelgrass, the effects of which have been tested using two field experiments: cages to remove predators and Ulva additions to uncaged plots. I found that the factors underlying microhabitat use vary among taxa: abundance of some taxa was clearly driven by predation (caprellid amphipods), whereas other species were clearly negatively influenced by Ulva presence (isopods). I also found evidence for antagonistic interactions among mesograzers, as predator-driven reductions in caprellids increased the abundance of polychaete worms and gammarid amphipods. Thus, my initial hypothesis that Ulva reduced all mesograzers was replaced by a more complex one in which predators, habitat, and antagonistic interactions among species determine grazer community composition.

| Bryn Ritter |

Major: Neurobiology, Physiology, and Behavior
Mentor: Laura Tully
Research Type: UHP Thesis

Contribution of Biological Sex and Social Sensitivity to Comorbid Psychosis and Cannabis Use Disorder

Cannabis use (CU) is prevalent in individuals with early psychosis (EP) and associated with worsened prognosis. Prior literature indicates males endorsing CU at a younger age are more likely to develop cannabis use disorder (CUD). We hypothesize social factors (e.g., rejection sensitivity, social anxiety) increase CUD risk, particularly for males. 144 (62 female) EP and 48 (28 female) healthy control (HC) participants completed CU measures (CUPIT, DUSI-SU). A subset [26EP (14 female), 45HC (27 female)] completed rejection sensitivity, social anxiety, and emotion regulation (ER) measures. Preliminary analyses indicate EP initiate CU at a younger age and are at greater risk of developing CUD. 29% of EP and 0% of HC who endorsed CU in the prior 12 months met CUD criteria. Among individuals reporting cannabis as their primary substance, individuals with CUD were more likely to cite "to decrease anxiety/relax" as their primary reason for CU. Significantly more EP males endorsed CU, but no sex differences emerged amongst participants with CUD. Increased rejection sensitivity was associated with increased risk of developing CUD in males (r=0.54, p=0.03) and decreased risk in females (r=-0.46, p=0.08). Results demonstrate importance of examining sex effects in CU. Future analyses will examine CUD and ER relationships.

| C. Tyler Smith |

Major: Biological Sciences
Mentor: Meaghan O'Keefe
Research Type: UHP Thesis

The Potential of Interdisciplinary Humanities, Ethics, and Social Science Courses to Fill Academic and Skill Based Gaps in Undergraduate Pre-medical Education

In 2015, the Association of American Medical Colleges restructured the MCAT exam to address incoming medical students' lack of academic experience in humanities, ethics, and social science subjects. Additionally, medical schools now want their applicants to demonstrate critical analysis and problem solving skills that are founded in medically-relevant areas outside of traditional STEM subjects. While these events have encouraged undergraduate institutions to provide a more comprehensive education for pre-med students, science-focused majors have been slow to give students credit towards their degree for humanities, ethics, and social science courses. Furthermore, the variety of interdisciplinary courses remains low for pre-med students. This study will examine the perspectives of undergraduate students regarding the interdisciplinary course options available to them. We hope to learn about students' likelihood of enrolling in interdisciplinary courses based on whether they get credit towards their degree. Additionally, the study will collect students' opinions about the academic preparedness of those going into pre-health fields through surveys distributed to students of the UC Davis Honors Program and College of Biological Sciences. This study will help determine which avenues of curriculum development are practical to pursue in pre-med education at UC Davis.

| Sinha Sankalp |

Major: Genetics and Genomics
Mentor: Shuai Chen
Research Type: UHP Thesis

Using Machine Learning to Accurately Diagnose Type II Diabetes Mellitus

According to CDC Statistics (2017), over 30.2 million individuals over the age of 18 have diabetes. Of these individuals, 95% of them have type 2 diabetes. Nearly 1 in 4 of these individuals did not know they had the condition, and 11.6% of individuals with prediabetes knew they had it. Diagnosed diabetes costs $327 billion in expenditures annually, via inpatient care, emergency department visits, and productivity burden. Consequently, the early and accurate diagnosis of diabetes is essential to preventing the development of comorbidities and reducing healthcare costs. The International Expert Committee supports using the hemoglobin A1c test (HbA1c) to diagnose Type II Diabetes Mellitus (T2D) because of its high specificity value. This test, however, has relatively low sensitivity values. Additionally, attaining a HbA1c test result is not as convenient as using noninvasive clinical measures, which resultantly forms an obstacle to an early diagnosis. I compare binary classification learning algorithms to optimize the predictive ability to clinical-level diagnosis accuracy. Cross validation techniques were used to find the best classifier, and the algorithms were optimized to compete with HbA1c sensitivity and specificity values. This research suggests a scalable ability to use noninvasive, easy-to-attain clinical measures to make a preliminary prediction of T2D.

| Arianna Stokes |

Major: Evolution, Ecology, and Biodiversity
Mentor: Frances Moore
Research Type: Thesis in Major

An Analysis of Expenditures Under the Endangered Species Act: How Your Taxes are Divided Between the Bakersfield Cactus and the Fresno Kangaroo Rat

The Endangered Species Act (ESA) offers the most rigorous protection of American biodiversity available under US law. The ESA, however, is chronically underfunded; few species of the over 1000 species listed as threatened or endangered by the ESA receive adequate funds for recovery. The allocation of resources to conservation efforts that benefit individual species reflects a decision of prioritization among species with competing needs. Using data extracted from publicly accessible US Fish and Wildlife Service (USFWS) reports, two decades of annual government expenditures on recovery efforts for individual species will be analyzed to determine how government agencies allocate resources among species. Patterns in species expenditures will be assessed with respect to species attributes that are constant or variable over time. The analysis will identify attributes that increase a listed species' likelihood of receiving funding under the ESA. Additionally, the results will allow for an evaluation of government adherence to the ESA's stated priorities.

| Ngoc-Han Tran |

Major: Genetics and Genomics

Mentor: Neil Hunter

Research Type: Thesis in Major

Chromosome translocation modulates patterns of pairing and recombination during meiosis.

Meiosis is the cellular division process that forms gametes in sexually reproducing organisms. Through two successive rounds of chromosome segregation, meiosis ensures that gametes contain a haploid set of chromosomes. Defects in meiosis lead to chromosomal aneuploidy causing birth defects and spontaneous pregnancy loss. The incidence of aneuploidy has been linked to defects in chromosome pairing and recombination that occur prior to the first meiotic division. Here we analyzed the effects of a heterozygous chromosome translocation on meiosis and its associated reproductive defects in mice. Comparison of mouse spermatocyte and oocytes revealed distinct pairing patterns between the translocated chromosomes and their homologous partners. In spermatocytes, secondary chromosomes frequently engaged in abnormal pairing interactions, while in oocytes, only the translocated chromosomes were aberrantly paired. Unexpectedly, translocation points were invariably associated with crossovers suggesting that homology boundaries can locally stimulate recombination. Although translocated chromosomes were associated with persistent DNA damage during prophase and aberrant connections during metaphase, they appeared to go undetected by meiotic checkpoint machinery, leading to a high incidence of aneuploidy in gametes. Our data point to local effects of translocations on recombination and a limited ability of quality control processes to prevent the propagation of defective chromosomes.

| Lakshmi Warrier |

Major: Biochemistry and Molecular Biology

Mentor: Sean Burgess

Research Type: Thesis in Major

Determining the role of the Nup2 MAR in the meiotic progression of S. cerevisiae

Meiosis is responsible for the formation of sperm and egg cells. Errors in meiosis could result in serious or fatal abnormalities, therefore, it is crucial to understand the mechanisms of the proteins responsible for its healthy progression. Brewer's yeast, Saccharomyces cerevisiae, is used as a model due to its conserved proteins and functional pathways. Using mutation analysis, a 60 amino acid region of the yeast nucleoporin Nup2 has been found to affect normal meiotic progression. The exact function of this region, termed the meiotic autonomous region, MAR, is unknown, and there are currently two possibilities: an inhibitory activity or a chromatin binding activity. Bioinformatics research reveals that a corresponding region in a homologous protein to Nup2 in Mus musculus interacts with cyclin-dependent kinase inhibitor 1B, suggesting that the MAR could possess this activity. Previous research also suggests that the MAR binds to meiotic chromosomes. Analysis of chromosome spreads reveal the MAR binding to chromosomes at the nuclear envelope, and mutations at selected residues result in a null phenotype. It is unlikely that the MAR possesses both activities due to its small size, and analysis of the MAR mutants can better determine its properties.

| Chloe Wei |

Major: Genetics and Genomics

Mentor: Marina Crowder

Research Type: Thesis in Major

Addressing Student Misconceptions in Meiosis in an Upper Division Genetics Course

A solid understanding of meiosis is crucial and fundamental in a student's study of genetics. Misconceptions in meiosis can act as major learning barriers for comprehension of other genetic concepts. The purpose of this study is to assess common student misconceptions regarding meiosis in an upper-division, high enrollment genetics course at UC Davis, and what learning activities are effective at correcting these misconceptions. A detailed understanding of what students struggle with at this level of genetics is essential for informing how to modify our curriculum and which learning activities best support students' understanding. A pre-survey was administered in Week 1 of the course to gather information about common misconceptions students have regarding meiosis. To assess the effectiveness of different learning activity structures in correcting these misconceptions, a post-survey was administered after students participated in either a hands-on activity or an interactive video activity that reviewed meiotic chromosome segregation. Preliminary analysis revealed that students commonly struggle with distinguishing between unreplicated and replicated chromosomes and distinguishing between homologous chromosomes and sister chromatids. Further analysis is in progress to determine if one type of learning activity - and if so, which type - is more effective at correcting these misconceptions.

| Reese Wilson |

Major: Biochemistry and Molecular Biology

Mentor: Gerald Kayingo

Research Type: UHP Project

Train the Trainer for Healthy Smiles: Improving Knowledge and Attitudes of Future Health Professionals on Oral Health

The oral cavity is a gateway to the rest of the body, therefore, oral health is crucial for overall well-being. Yet, due to limited access, education and poor attitudes, dental care is the most common unmet health need in America, particularly, in racial and ethnic minorities. According to the centers for disease control (CDC), about 47% of U.S. adults have some form of periodontal disease. There is an urgent need for action both at an individual and population level. The purpose of this project is to improve the knowledge, skills and attitudes of future health care professionals towards oral health care. With the use of didactic presentations and hands-on exercises, UC Davis pre-health students will be trained on self-preventative oral care, basic oral exams, and the importance of dental-physician partnerships. Trained pre-health students will engage with college students and the Davis community to train and advocate for oral health. Improvement in knowledge will be assessed using surveys and direct observations. We hope that the educational intervention at the college level will create needed awareness to improve oral health in our communities.

| Moses Wolfe-Polgar |

Major: Biochemistry and Molecular Biology

Mentor: David Furlow

Research Type: UHP Project

Dietary and Fitness Recommendations for the Sacramento Police Department Based on Fitness, Health, and Body Composition Metrics to Address Most Acute Health Risk Factors

Purpose: Law enforcement officers are at risk of developing chronic heart disease (CHD) because of the stress and long hours of inactivity at work. This work establishes a precedent on how to address specific health risks of a law enforcement group. Methods: Data on body composition and fitness was collected for 127 individuals from a single department to identify shared health risks. 17 return visits were also analyzed for success of current recommendations. Results: Greatest risk factors were body fat percentage and cardiovascular fitness. Self-driven changes between appointments were largely ineffective. Review: A literature review was done to evaluate best practices for improving these risk factors and for promoting lifestyle changes in the workplace. Conclusions: Improving health requires long-term changes, which are best accomplished through a few simple changes and creating a system of support and incentives. A handout was developed outlining the suggested changes, and it was determined that the department should institute an incentivized workplace health promotion program.

| Yue Yu |

Major: Biochemistry and Molecular Biology

Mentor: Dave Furlow

Research Type: UHP Project

Improving Chinese International Students' Mental Healthcare in UC Davis

Chinese international students make up the largest proportion of international students in United States, with more than 544,500 Chinese students studying at US universities in 2016. At UC Davis, international student enrollment has been growing quickly, and is currently 14% of the undergraduate student body. About 68% of those students are from China, meaning there are nearly 3,000 students from China at UC Davis alone. A growing concern for all undergraduates, including international students, is the status of their mental health. Over the past 10 years, mental health treatment for undergraduate students went from 19% to 34%, and the percentage of students reporting overwhelming anxiety, debilitating depression, and thoughts of suicide rose by 38% (40-55%), 31% (32-42%) and 116% (6-13%), respectively. Importantly for my study, Asian American students were reported to make up 61 percent of suicides at Cornell, and the Asian American suicide rate in MIT is four times the average.

College of Letters and Science

| Taylor Aamot |

Major: English

Mentor: Mark Jerng

Research Type: Thesis in Major

Crises of the Self in Crime Fiction

Agatha Christie shattered the expectations of Crime Fiction when she revealed the narrator of *The Murder of Roger Ackroyd* to be the killer, creating one of the biggest and most controversial twists in the history of the genre. Far from being just a clever trick, this positioning of the narrative perspective to the opposing side of the detective's work allows for a close view at elements of the human experience that were critical in forming the genre: conflicts of the self and the other such as identity, egoism, and competition. To show this, I will be balancing a close reading of *The Murder of Roger Ackroyd* with a survey of if the Detective Fiction genre, as well as contextualizing Christie's representation of crime and the criminal within psychology, criminology, and philosophy. A historicization of the genre within these contexts will reveal how they codified the manner in which Crime Fiction can represent the self. *The Murder of Roger Ackroyd* explores the connections between identity, society, and crime as they are inextricably formed in relation to each other.

| Nicholas Archibald |

Major: History

Mentor: Daniel Stolzenberg

Research Type: Thesis in Major

Dueling Discourses. A Revisiting of History's Remembrance of Sir Kenelm Dibgy

Many examinations of 17th century intellectual history take the form of narratives emphasizing the forces of change from an archaic, Aristotelian framework to modern methods of experimentation. The literature often leaves little room to analyze the continuity of tradition, or tease out the intricacies of the transition. In reading through this lens, one finds either explicitly stated or implied antagonism between the scholastic method of gaining knowledge and the new experimental school. When looking more closely at the works of philosophers themselves, this assertion of a black and white transition is found to be unconvincing. For this reason, it is necessary to reexamine the narrative presented and find a more nuanced view. In this undertaking, I will be taking a second look at the enigmatic figure of Sir Kenelm Digby (1603-1665). A politician, scholar, duelist, and conspirator, Digby fit the archetype of an Elizabethan gentleman, yet my interest is in how historians have understood his philosophy. As scientific thought diversified into several branches, separating Aristotelian thinkers from those seeking to replace it with modern experimentalism, Digby found himself between the two worlds. Kenelm Digby's thinking takes the form of a seemingly unstable amalgam. His matter theory and understanding of what the world is composed of is strongly Aristotelian. Yet as a fellow of England's esteemed Royal Society and contemporary of French Mathematicians Marin Mersenne, and René Descartes, Digby's work also incorporated, almost wholly, atomism and a Cartesian method of describing motion and the workings of matter. The tension arose between the opposing conceptions of matter as elements that change states to create the natural world, and elements as atoms that retain their composition, and seek different arrangements to form the various things that are observed. This debate stemming from the foundation of matter created apparently antagonistic theories of how it operated.

| Romae-Anne Aquino |

Major: International Relations

Mentor: James Adams

Research Type: Thesis in Major

What Influences Public Opinion on Immigration in Europe? A Cross National Analysis Following the Great Recession

What influences public opinion on immigration in Europe? While previous studies provide evidence for either the size of immigrant populations, non-economic determinants or economic concerns to explain public attitudes on immigration, such studies either: 1) do not concentrate on a cross-national analysis of European countries, 2) when data from Europe is used, it does not take into account data following the 2008 financial crisis, and finally 3) the data does not explicitly focus on perceptions of job security over time. My research aims to rectify these overlooked concerns from the previous literature. I examine in my paper an interaction between unemployment and size of immigration for public opinion on immigration in European countries. I explore what explains attitude formation on immigration in Europe using linear regression for both an interaction model and non-interaction model, which builds upon group conflict theory and self interest theory. I hypothesize that the variations among economic threat, particularly job security through the measure of unemployment, and size of immigrant populations together influence public attitudes towards immigration. According to the quantitative analysis, I came to surprising results. I find that the correlation between unemployment and public opinion, and the interaction variable and public opinion are not statistically significant, thus my hypotheses cannot be completely supported by the quantitative analysis. My findings suggest that the public attitudes on immigration among European may not be significantly influenced by the interaction between unemployment and immigration within their respective European countries.

| Natalia Arredondo |

Major: English

Mentor: Frances Dolan

Research Type: UHP Project

Diversity in DA Offices and its Impact on Communities

The idea and passion for this project to come to life is based off of years and years of minority distrust of the criminal system, and particularly its tensions with District Attorney Offices. Although this is a nationwide issue, the California District Attorneys Association and I wanted to pay particular attention to our own state- California. Interest to fund this project was brought up by a compelling 2015 Stanford study that cited significant factors that contribute to the mistrust and tension between DA offices and communities. Essentially DA offices are not representative of the communities they serve. We decided that in order to have more diversity among prosecutors there needed to be two objectives to our project. First, students of color do not graduate from law school at high rates in general, so we need to educate users on pathways to law school via our website, www.californiaprosecutors.org. Second, interest in prosecutor positions can only be achieved by actual contact with DA offices where we have extensively created a cohesive page of internship opportunities for high school students, undergrads, and law students in their respective DA County Offices. This was a critical component to our project because stigmas of prosecutors can only be faced when individuals can have an inside look on the work of prosecutors and how they can change or contribute to DA offices across California with a law degree. Our goal is to foster interest and provide a first ever prosecutor law related website that minority students can utilize to aid them in their process of becoming future prosecutors. Our project is to plant a seed that will eventually provide more justice and representation at the legal level in DA Offices.

| Alex Asera |

Major: Psychology

Mentor: Peter Mundy

Research Type: Thesis in Major

Exploring the Role of Structural Language Skills in Predicting Language Comprehension Abilities in Children with Autism Spectrum Disorders

This paper explores the role of structural language abilities as a possible predictor of language comprehension abilities in children with Autism Spectrum Disorders. In the effort to identify the root cause of comprehension deficits commonly seen in ASD individuals, structural language abilities have emerged as a promising predictor of comprehension, contradicting the theory that cognitive deficits specific to Autism are the primary cause of these deficits. Here, 44 early elementary children with ASD were given oral linguistic comprehension assessments, as well as vocabulary assessments and inventories assessing degree of ASD symptoms. Regression results indicate that receptive vocabulary (a component of structural language skills) was indeed a significant contributor to language comprehension skills, while Autism symptoms did not significantly predict comprehension ability. These findings add to the growing body of evidence suggesting that structural language abilities can predict language comprehension, and that this pattern holds true in the early elementary age group.

| Lisa Banga |

Major: Comparative Literature

Mentor: Elizabeth Freeman

Research Type: Thesis in Major

A Touch of Magic: Reconceptualizing the Female Experience Through Magical Realism

Amidst a time of political and social turmoil in the mid-twentieth century, Latin American writers flourished, and their works spread across the globe. This Latin American Boom popularized magical realism, a genre that recounts the magical as the real and blends the fantastical with the mundane. Latin American writers such as Gabriel García Márquez and Jorge Luis Borges have used the genre as a tool to reclaim their histories, weaving fiction into the past to critique the falsities existing in their countries' official histories. While magical realism criticism has discussed the ability to rewrite and to reclaim history, a smaller body of research exists on how magical realism reimagines female histories, specifically female bodies and female sexuality. My research examines how female Latin American writers reconceptualize individual, personal female histories using magical realism. Looking specifically at Laura Esquivel's Like Water For Chocolate and Isabel Allende's The House of the Spirits, I explore how female characters interact with the magical elements of their narratives and how the magical functions as an extension of their bodies and as a reimagining of their sexualities.

| Nomundari Batmandakh |

Major: Computer Science

Mentor: Xin Liu

Research Type: Engineering Design Project

Interactive Educational Clinical Ophthalmology Application

Our goal is to develop an interactive open source iOS application that presents condensed, high yield content in a way the optimizes study efficiency and improves performance of ophthalmology residents on routine ophthalmology assessment exams using a spaced repetition system. Spaced repetition is defined as a learning technique that uses intervals of time to leverage the psychological spacing effect. This effect is used by many to improve the efficiency of learning and memorization. Our application presents information in a slide show vision occlusion format and takes in user feedback per slide to better curate future study content.

| Christina Boyar |

Major: Cognitive Science

Mentor: Eva Schepeler

Research Type: UHP Project

University Honors Program Mental Health Initiative

The state of mental health among college students is an issue that has been thoroughly studied in recent years after increased public awareness. What is lacking, however, is research specifically on honors students' mental health which we suspect is uniquely at risk because of the high expectations to succeed placed on them by themselves and others. This study aims to shed light on this issue by administering a survey to students in the University Honors Program (UHP) at UC Davis asking students about their UHP experiences, their mental state, and their knowledge of campus mental health resources. The preliminary results of this investigation suggest that honors students are stressed about honors classes, lack of support from UHP staff, and program requirements (i.e. GPA). The ultimate results of this survey will be used to produce a series of mental health workshops for honors students and will provide insight to UHP staff on how to best support students in UHP. Overall, these results will serve as a starting point for shifting the culture surrounding mental health in honors students, so that future UHP students will be better prepared to manage their stress and consistently prioritize their mental health.

Ceara Brashears

Major: Sociology
Mentor: Caitlin Patler
Research Type: Thesis in Major

Cross-Cultural Competence in Spanish-Immersion Schools

Along with teaching bilingualism, one of the main goals of Spanish immersion schools is to promote cross-cultural competence amongst their students. However, despite aspiring to provide a setting in which students from different backgrounds can mutually benefit from cross-cultural interactions, consumptive contact theory predicts that programs with predominantly white native-English speakers (known as one-way immersions) value Spanish as a commodity. Meanwhile, intergroup contact theory predicts that programs with a more even mix of native-English and native-Spanish speakers (known as two-way immersions) value Spanish as a heritage language. Building off this research, in my comparative case study, I conducted 10 original in-depth interviews with teachers at two different schools, 5 who teach at a one-way immersion and 5 who teach at a two-way immersion. I examine how these teachers promote cross-cultural competence in their classrooms with the following research questions: How do teachers promote cross-cultural competence in Spanish-immersion schools? How does this compare across schools?

Sally Burke

Major: Chemistry
Mentor: Alexandra Navrotsky
Research Type: Thesis in Major

Carbon Incorporation into Magnesium Silicate via Laser Ablation

Carbon storage in the Earth's interior is an ongoing subject of research and the question of how carbon can incorporate into silicates remains unanswered. A class of materials called polymer-derived ceramics (PDCs) have demonstrated the potential for carbon to substitute for oxygen in silicate tetrahedra. Silicon oxycarbide (SiOC) synthesized from polymeric precursers have been found to contain amorphous regions of SiC_xO_{4-x} ($x \leq 4$) tetrahedra. In addition, thermodynamic studies have shown that SiOC PDCs are more stable than their crystalline components. The stability of these materials suggests that they could form by other methods, including in natural geological processes. Laser ablation is one example of synthesis method that has similarity to natural processes. In this study, significant carbon incorporation is found in the product of ablated magnesium silicate. Following decades of research with collaborators across the globe, these findings add to the potential for carbon substitution into silicates to be another method of carbon storage in the earth's interior.

Vannalee Cayabyab

Major: Political Science
Mentor: Ethan Scheiner
Research Type: Thesis in Major

Institutional Determinants of Local Immigration Policy

Cities across the United States have recently passed sanctuary policies to protect unauthorized immigrants from the Trump administration's increased efforts to detain and deport these individuals. However, localities must face the consequences of taking stances that are in conflict with the stances of the federal and state levels of government. These disagreements call into question the power of cities. What pressures enables cities to pass immigration-enforcement related policies? I theorize that the proportion of unauthorized immigrants in a city and its legal structures affect its government's decision to develop and pass its own legislation or to enter into an agreement with the federal government. California hosts the largest unauthorized immigrant population in the country and grants different types of authority to general law cities and charter cities. I examine the correlation between the existence of sanctuary policies and 287(g) agreements, one pro-immigration policy and one anti-immigration policy, in 482 cities in California and each city's type and immigrant population. This research contributes to existing theories on how cities can protect their unauthorized immigrant population from federal and state forces through policy.

Sierra Chapman

Major: Physics
Mentor: Andrew Wetzel
Research Type: Thesis in Major

The Abundance of Dark Matter Halos Near the Milky Way Galaxy

Dark matter is one of the most essential ingredients in cosmology but remains one of the biggest mysteries in the field. In the standard cosmological model, dark matter collapses under its own gravity into clumps known as halos. While massive halos become the sites of galaxy formation, the lowest-mass halos are expected to be starless and completely dark. Although challenging to detect, the lowest-mass halos could provide valuable information because they are the most sensitive to the nature of dark matter. A promising possibility is to indirectly detect starless halos by finding perturbations they create in stellar streams around the Milky Way. However, cosmological simulations that include gas, stars, and dark matter have found that Milky Way-like galaxies efficiently destroy nearby dark matter halos. In order to provide insight into the likelihood of halo-stream interactions, I have computed the rate of infall and time-averaged number of halos at various distances from Milky Way-like galaxies in cosmological simulations. I find that a small but detectable number of halos survive to reach the distances of stellar streams, suggesting that halo-stream interactions remain a plausible method for detecting starless dark matter halos.

Tara Choat

Major: Anthropology
Mentor: David Grenke
Research Type: Thesis in Major

Dance and Documentary Theatre: An Examination and Abstraction of Mental Health and the Body

The mind and the body are often thought about and researched in two separate categories, especially with the arts. In this project I am attempting to examine the dependence and relationship of the mind and body through dance and documentary theatre. The project has two main parts. The first involves a small group of subjects making "logs" or entries either every day, three times a week or once a week for 10 weeks. The logs provide the subject a space in which to express themselves and their mental status through writing, speaking, dancing, drawing etc. The logs are then analyzed in order to find trends, patterns, differences, and changes in mindset from start to end. Using this data, a dance piece will be workshopped, which uses aspects of documentary theatre, modern and commercial dance, and speaking. Each subject will not only have to occupy their own mental space, both past and present, but will also attempt to occupy the mental space of others. Through this research and workshopping the piece will demonstrate how powerful mental health can be on the body and how individual experiences can be shared yet unique.

Julianne Cravotto

Major: History
Mentor: Kathryn Olmsted
Research Type: Thesis in Major

"In God We Trust": Religious Opposition to the Vietnam War and the Birth of the Bay Area Sanctuary Movement, 1971-1972

In 2017, the Washington Times reported that five hundred American cities adopted sanctuary laws. Yet in 1971, Berkeley became the first city following demands for sanctuary from soldiers of the Vietnam War and local clergymen. Thus, the modern sanctuary movement began as eighteen parishes in the Bay Area formed the Sanctuary Caucus, providing legal counsel to soldiers who wished to obtain conscientious objector status. Consequently, these parishes united with the secular Left, the counterculture, and students to demonstrate their solidarity with draft resisters and to oppose federal law. In forming a united front, these parishes raised questions concerning the role of religion in politics and civil disobedience. By analyzing conscientious objector laws, Gallup data on religious groups' political views, and the archives of prominent figures such as Robert McAfee Brown and Gustav Schultz, this research aims to understand the factors behind religious opposition to the Vietnam War in the Bay Area, examining the local and national conditions which made it the testing ground for sanctuary law. Moreover, this study depicts the Vietnam crisis as the prototype for the recent sanctuary movement involving Latin American refugees and undocumented immigrants, challenging the common association of American religion with political conservatism.

Kavitha Dhanukodi

Major: Computer Science
Mentor: Xin Liu
Research Type: Thesis in Major

Stebbins iOS App

Cold Canyon is a natural reserve in Solano County, California. It is maintained by the University of California system, specifically by the University of California Natural Reserve System, in order to maintain the environmental health and to provide an educational site for students, teachers and researchers alike. Stebbins has approximately 60,000 visitors a year, for both recreation and research. The main goal is to create a mobile app for iOS that can serve as a "companion" when someone is visiting the reserve. This app will provide a live trail map along with a guide for points of interest on the trail, a field guide that gives info on flora and fauna, and a photo sharing option where the user can upload photos to the administration, who can then curate the photos for public use. The app will also provide a reporting system, where visitors can report if there is something wrong with a trail (a fallen tree, for example) and the administration can notify users if there is something to be aware of in the park (emergency warnings). We have implemented these four key features in the iOS application to help and accompany users on their hiking journey at Stebbins Cold Canyon Reserve.

Andrew Diggs

Major: Physics
Mentor: Rena Zieve
Research Type: Thesis in Major

Kelvin Waves on a Superfluid Vortex Core

Near 2 Kelvin helium undergoes a phase transition to a unique state known as superfluid. One the particularly interesting characteristic of superfluid are the quantized vortices that arise from angular momentum imparted on the system. We study the behavior of a superfluid vortex stretched between a wire and the wall of a cylindrical container. The wire is used to both excite and measure the vortex. Excitations of the wire result in oscillations of the vortex core know as Kelvin waves. Measurements of the amplitude and frequency of these waves are used to determine how mechanical energy introduced to the superfluid system is transferred to the Kelvin waves. Variations in the frequency and amplitude of the wire excitation, result in the excitation of different modes of the vortex core and in some cases give evidence of a transition to non-linearity. The study of this behavior could help us to better understand quantum turbulence in condensates.

| Jeske Dioquino |

Major: Physics

Mentor: Maxwell Chertok

Research Type: Thesis in Major

Effects of Radiation on Carbon Materials for High Luminosity Upgrade of CMS Silicon Tracking Detector

Future collider detectors, such as silicon tracking detectors for the High-Luminosity Large Hadron Collider (LHC) upgrade, will need materials of low mass, as well as sufficient mechanical strength, thermal conductivity, and radiation tolerance. These properties are essential for the detector, as the experiments study the interactions of particles of extremely high energies. These energies are increasing with the LHC luminosity, and so the detectors along the accelerator must be upgraded in such a way as to be able to handle these higher energies and rates of events. In this particular study we look at the thermal properties and tensile strength of small samples meant to model potential structures for the Compact Muon Solenoid (CMS) detector's silicon tracker. The samples are squares of carbon foam bonded on both sides to carbon fiber sheets using thermal epoxy. We look at how the thermal properties and tensile strength of the samples are different before and after exposure to radiation.

| Elizabeth Ford |

Major: History

Mentor: Lisa Materson

Research Type: Thesis in Major

Edna Woolman Chase: A Microhistory

Born and raised in a small Quaker village in New Jersey, Edna Woolman Chase moved to New York City and began working at Vogue when she was eighteen. Despite her gender and working class background, Chase went on to have an extremely successful and groundbreaking career as Editor-in-chief of Vogue from 1914 to 1952, at a time when very few career women existed. Yet, despite these achievements, no analysis or written history of her life exists. Through archival research at the Fashion Group International and the Ilka Chase Archive, as well as in-depth analysis of Chase's own autobiography and the autobiographies of her daughter and proteges, this research provides the first microhistory of Chase's life, atypical for the period, highlighting her class ascension and how she navigated gender norms of the period throughout her career. Placed into historical context, this microhistory provides a new lens through which to examine American society during the first half of the twentieth-century, especially in terms of class and gender; the retraction of women's rights and backlash post World War II; and the erasure of women throughout American history.

| Esme Grundy |

Major: Anthropology

Mentor: Randy Haas

Research Type: Thesis in Major

Paleobotanical Analysis of Crater Middens, a Residential Site in Owens Valley, California

The site of Crater Middens in Owens Valley was originally excavated by Dr. Robert Bettinger and colleagues in 1981. Some of the samples intended for paleobotanical analysis collected during this original excavation were analyzed, but many were left unanalyzed. In order to reconstruct the subsistence patterns of the inhabitants of Crater Middens, we performed paleobotanical analysis on some of the samples remaining from the original excavation. We were also interested in how our analysis differed from the original analysis with different flotation and analytical techniques. We used flotation with a Flote-Tech machine to recover paleobotanical material from the samples. The recovered material was then graded by size and sorted for charred seeds and nutshell under a microscope. Seeds and nutshell were identified, if possible, to species level and counted. We will then perform statistical tests in order to better understand the subsistence patterns of the inhabitants of the Crater Middens site and in order to compare what we have recovered with the original paleobotanical analysis.

| Cristina Harber |

Major: English

Mentor: Tobias Menely

Research Type: Thesis in Major

The Materialization of Free Will in Milton's Paradise Lost

Most of the conversation concerning free will in John Milton's *Paradise Lost* tackles it as a metaphysical and theological problem; however, I am interested in how it is materialized within the poem through Eve. Specifically, I am interested in the way Eve represents herself in the narrative as a person capable of critical and provisional thinking. Possessing these two qualities, I argue, is a tangible signal of free will. For example, Eve's dream in Book 5, while at least partly influenced by Satan, also contains traces of her planetary discussion with Adam the day before—leading me to think that part of the dream is her own unconscious design. Thus, the dream scene is not one of total manipulation and objectification of Eve, but a moment where she exercises her potential for cognitive provisionality. To complete this project, I will be looking at moments in *Paradise Lost* where the narrative could have taken multiple trajectories, other primary texts regarding predestination, such as Luther and Erasumus: Free Will and Salvation and Milton's On Christian Doctrine, as well as sources that deal with fictionality's rhetorical purpose, such as Catherine Gallagher's article "The Rise of Fictionality".

Hyeyeon Hwang

Major: Computer Science
Mentor: Janine M. LaSalle
Research Type: UHP Thesis

Machine Learning of Diagnostic Predictors for Autism Spectrum Disorders

Autism spectrum disorders (ASDs) are a diverse collection of neurodevelopmental disorders characterized by restricted interests, repetitive behaviors, and impairments in social interaction. There are currently no reliable biomarkers for the diagnoses of ASDs, so they are clinically diagnosed by behavior, which makes early diagnosis challenging. To address this challenge, I established machine learning models to discover potential DNA methylation predictors of ASDs. DNA methylation is a common type of DNA modification that does not change the underlying DNA sequence and is dynamically shaped by neurodevelopment. I used the caret package in R to perform 5-fold cross validation with a model built using the random forest (RF) machine learning algorithm on individual and combined DNA methylation datasets generated from three sets of brain samples and one set of placenta samples. RF models from three individual brain, placenta, combined brain, and combined brain and placenta datasets yielded accuracies of 1, 1, 0.927, 0.975, 0.723 and 0.816, respectively. The results suggest that RF models built from brain and placental DNA methylation data may significantly aid in early diagnosis of ASDs. Early diagnosis is crucial as it allows for early intervention, the key to optimal outcomes for children diagnosed with ASDs.

Emily Jones

Major: Political Sciences
Mentor: Ryan Hubert
Research Type: Thesis in major

Judging the Justices: External Influences and the US Supreme Court

The US Supreme Court is often perceived as a final defender of civil rights in America, rulings sometimes dependent on the judgement of only one or two justices. In seeking to explain the behavior of US courts and understand the forces at play in these outcomes, many scholars have looked at the relationship between the characteristics of a judge and their verdicts. Little research has looked to explain court behavior through the influence of forces beyond the court itself, particularly in regards to the US Supreme Court. This study attempts to fill this gap by evaluating the effect of public opinion and national security on US Supreme Court behavior regarding free speech. The study uses a multiple regression analysis to determine the correlation between these external influences and both Supreme Court petition acceptance and Court decisions. The relationship between the external influences and Court behavior appears insignificant under the predicted circumstances, although an increase in petition acceptance was associated with positive public opinion and decreased national security. These findings demonstrate the failure of national security and public opinion to explain behavior regarding free speech cases, but suggests that a relationship between these external influences and Court behavior may exist within a different framework.

Simran Johal

Major: Psychology
Mentor: Simona Ghetti
Research Type: Thesis in Major

Changes in White Matter Integrity and the Development of Introspection Ability: A Longitudinal Analysis

Metamemory monitoring, the ability to introspect on one's own memory accuracy, improves throughout childhood and into adolescence (Fandakova et al., 2017). Previous research has shown that the medial temporal lobe (MTL) supports memory performance, and the prefrontal cortex (PFC) and the parietal cortex (PC) may be particularly important for metamemory (Fandakova et al., 2017; Chua, Schacter, & Sperling, 2009). However, little is known about how white matter tracts, which allow for communication between these brain regions, support the improvement in metamemory monitoring, and how this changes with development. To address these questions, we examined a longitudinal sample of participants between the ages of 7 and 15 years (T1: N = 155, T2: N = 122, T3: N = 92) who were assessed for their metamemory monitoring abilities. Additionally, data on participants' white matter tracts were collected using diffusion tensor imaging, a structural brain imaging technique. We hypothesized that tracts connecting the PFC, PC, and MTL would show increased connectivity during this transitional period, and that these improvements would predict the development of metamemory monitoring ability. This investigation will help reveal the development of connectivity between brain regions during middle childhood and adolescence, and their role in memory and metamemory improvements.

Spencer Katz

Major: Political Science-Public Service
Mentor: Christopher Hare
Research Type: UHP Thesis

The Swing Voter and the Ground Campaign: How Political Practitioners and Political Scientists Understand Persuadable Voters

Campaign organizations seek to change the outcome of elections through tactics collectively known as the ground campaign. These efforts are focused on mobilizing supporters and persuading those with ambiguous allegiances. The decisions made by campaigns as they design their winning coalition holds important implications beyond the electoral context. Recently, the rise of big data and microtargeting models has provided political operatives with extremely advanced methods of identifying voter groups. Popular media ascribes a nearly omnipotent predictive power to these data models, however, political science research casts doubt on such characterizations. Likewise, practical considerations regarding implementation and electoral context underlie the targeting decisions and strategies pursued by campaign operatives. Political science has long theorized about the causes and characteristics of swing voters. While social science research has directly impacted ground campaign tactics, the academic literature on persuadable voters is disconnected from the practical implementation of persuasion targeting. Using survey data from the 2016 Cooperative Congressional Election Study (CCES), this study will evaluate how swing voters from the 2012 to 2016 Presidential elections map onto the traditional targeting tables designed by campaign strategists.

Jared Kohn

Major: English

Mentor: Gregory Dobbins

Research Type: Thesis in Major

Non Serviam: Dismantling Normativity in James Joyce's *Ulysses*

James Joyce's *Ulysses* explores the relationship between personal identity and narrative. The novel shows how different characters interact with and understand the world on a personal level by tethering their narration to literary styles. Literature, newspapers, and stories frame every narrator's thoughts. Leopold Bloom thinks in direct sentences that resemble news articles, and Gerty casts herself as the lead in a romance novel with sentimental prose. Everyone in *Ulysses* understands themselves based on what they read. At the same time, storytelling invents normativity. Almost every character in Joyce's Dublin uses literature and tropes to define what they consider normal. Narratives build normative frameworks that codify everything from how an artist acts to gender roles. Those frameworks cannot account for Gerty MacDowell's physical disability or the complex natures of Stephen and Leopold. These characters alienate themselves by forcing their identities into restrictive archetypes. They lack the cultural imagination to understand themselves and rely on generic tropes for self-classification. *Ulysses* eventually reveals that the transformative power of creativity can dismantle these frameworks, creating space for self-understanding. Imagination subverts cultural expectations and allows the characters to transcend the normative, prompting them to challenge their orthodox identities.

Adon Kwong

Major: Pharmaceutical Chemistry

Mentor: Annaliese Franz

Research Type: Thesis in Major

Synthesis of Indole-Based Hydroxamic Acids to Investigate as HDAC Inhibitors

The various isoforms of histone deacetylase (HDAC) enzymes have been linked to cancers and inflammatory diseases. Hydroxamic acids are commonly used as HDAC inhibitors due to the strong chelating effect to the Zn2+ in the active site. The goal of this research project is the synthesis of indole-based hydroxamic acids to investigate as selective HDAC inhibitors and the effect of structure on binding and selectivity. The target molecules were designed with inspiration based on a known HDAC8-selective molecule, featuring a hydroxamic acid as a zinc-binding group and an indole core. The synthetic route to access the target molecule involves four steps, each of which has been investigated and optimized. The synthetic steps include an N-substitution of the starting indole, hydrolysis to reveal a carboxylic acid, amide coupling to attach a linker component, and the final transformation to the desired hydroxamic acid. The final products are characterized using H1 NMR spectroscopy and mass spectrometry. By changing both the length of the molecule and the substituents on the indole cap, this exercise in synthesis aims to produce a set of compounds whose HDAC selectivity and inhibition will be used to find structure-activity relationships on HDACs.

Olga Lukashina

Major: Statistics

Mentor: Alexander Aue

Research Type: Thesis in Major

Problem with Win Probability

The purpose of the paper is to develop a model for predicting NBA win probability given the current state of the game, at any time t. The authors highlight three current issues with existing winprobability models: 1) lack of context, 2) no measure of prediction uncertainty, and 3) no publicly available data sets or models against which to compare. They believe that win probability models "should be responsive to in-game contextual features". For this work, I am using the dataset compiled by STATS of over 8.7M NBA play-by-play events from the 2002-2003 through 2016-2017 seasons. The dataset consists of various features, 352 in total for each play-by-play event, including information about the home and away teams, information about individual players, as well as the running tally of team score, assists, blocks, fouls, rebounds, steals, turnovers, and more.

Lorenzo Mambretti

Major: Mathematics and Scientific Computation

Mentor: Niels Grønbech-Jensen

Research Type: Thesis in Major

Anomalies in Discrete Time Statistic for Langevin Dynamics

We present an analysis of detected statistical anomalies in the results of applying the GJF algorithm for simulating Langevin dynamics in discrete time to a simple one-dimensional oscillator with friction and noise such that thermal equilibrium is obtained. The anomalies are detected in, e.g., calculations of energetic averages, where particular oscillations around the correct value are noticed as a function of the applied time step. The algorithm is expected to yield time step independent statistics regardless of the choice of parameter values. The magnitude of the anomalies increases with increasing temperature and decreasing friction, and the variations disappear when the dynamics become overdamped. We investigate the nature and the cause of the unexpected variations in the statistics for a simple system from which definite conclusions can be drawn. The results illuminate the cause of the observed anomalies, which are results of critical sensitivities in computational statistical mechanics when demanding high precision statistics.

| Elisabeth McAllister |

Major: Design

Mentor: Christina Cogdell

Research Type: UHP Thesis

A Socio-ecological Design Strategy For Monitoring Global Material Flows

This project applies human-centered design practices to ecological challenges and outlines a strategy for the creation of an interactive tool to measure and monitor global material flows. This strategy was developed in partnership with Origin Materials, a biomaterials company based in West Sacramento, California. The creation of such a tool is predicated upon the fact that much of the information on the material flows that coalesce to shape our world is invisible. Current efforts to standardize the records of movements of materials communicate the available information to technical audiences but are inaccessible to consumers. As a result, both consumers and producers lack a common language with which to approach the resource-challenged world and, consequently, are unable to make well-informed manufacturing and purchasing decisions. Yet a multiplicity of underutilized data sources exist. Ethnographic research methods and a literature review of texts on network science, prospect theory, data visualization, and critical data studies were implemented to create a strategy to address these areas of disconnect. Finally, mock-ups were produced to imagine a successful strategy to empower both users and consumers with an interactive, open-source data visualization tool intended to provide clarity on the attributes of materials and their life-cycles.

| Brooke McMahon |

Major: Environmental Chemistry

Mentor: David Goodin

Research Type: Thesis in Major

Increasing Student Preparedness and Learning in the Laboratory: Redesigning the Laboratory Manual

Undergraduate students that are majoring in chemistry are often required to take course centered around laboratory techniques. While this curriculum is valuable for students intending to pursue a graduate degree or work in industry, these same students often feel frustrated when they are in these courses. This frustration stems from laboratory manuals that are poorly organized and do not promote critical thinking; an example of this is UC Davis' CHE 115 class. This course is an analytical chemistry course that intends to introduce students to laboratory techniques as well as expose them to instruments that they will likely use throughout their career. Using student surveys, problem areas of the CHE 115 manual were identified. The manual was then combed through to systematically remove outdated information, replace confusing language, update the layout for visual clarity, and reframe the post-lab section to focus on scientific practices. Beginning in Fall Quarter 2019, this redesigned manual will be replacing the current version of the manual at UC Davis. It is predicted that this new manual will increase the course's learning value as well as student preparedness in the lab.

| Joseph Melkonian |

Major: Economics

Mentor: Giovanni Peri

Research Type: Thesis in Major

Making Money Move: Investigating Determinants of International Remittances

Money sent by immigrant workers to recipients in their countries of origin, also known as remittances, represents a significant international financial flow, particularly for developing economies. In recent years, remittance flows have exceeded official development aid and proven more resilient than foreign direct investment in the face of economic crises. While prior studies have examined various impacts of remittances on the developing world, I investigate what structural features and household characteristics may influence a migrant household's decision to remit. Combining World Bank and US Census survey data, I run a time series analysis to investigate which country of origin and diaspora community characteristics are associated with higher remittance flows from the United States. Using data collected from sub-Saharan immigrants residing in Belgium, I also conduct a cross sectional analysis to uncover how income, household size, and education, among other factors, may influence immigrant decisions on whether and how much to remit. By conducting a separate macro-economic and micro-economic analysis of remittances sent from two Western, developed countries, I hope to corroborate my findings and discover internationally consistent determinants of remittances.process using experimental methods.

| Chelyah Miller |

Major: Psychology

Mentor: Alison Ledgerwood

Research Type: Thesis in Major

Mental Health and the Quarter System

This paper served to examine the relationship between mental health and the quarter system. As the rate of psychopathy increases among UC Davis students, I examined the different variables involved as well as the different groups that were being affected. I focused on the rates of psychopathy among transfer students, the rates of psychopathy among seniors versus freshmen, as well as the correlation between socioeconomic status and rates of psychopathy. Method: Students from UC Davis (n= 567) participated in an online survey where they were presented with questions related to financial status, history of psychopathy, and the quality of the transition between a semester system community college and the quarter system. They were also presented with a Likert-scale with symptoms of common disorders such as depression, anxiety, and bipolar disorder. Results: I found that there was a correlation between socioeconomic status and psychopathy. There was also a correlation between transfer student status and psychopathy. The relationship between rates of psychopathy when comparing seniors and freshmen was approaching statistical significance. Conclusions: Findings highlight the necessity of improving resources dedicated to mental health as well as creating more resources dedicated to easing the transition for transfer students.

| Paige Morgan |

Major: Pharmaceutical Chemistry
Mentor: Marina Crowder
Research Type: UHP Project

Student-Facilitated Course on Writing Books for Pediatric Patients in Underserved Healthcare Communities

Oftentimes, there is a lack of reading material in the waiting rooms at clinics and children's hospitals; this is especially true for healthcare facilities in low income communities both locally and abroad. In order to engage students in creating books for children in these communities, we designed a first year seminar (FYS) entitled "Writing for Wellness: Creating Children's Books to Support Pediatric Patients in Underserved Communities". The main objectives of the course were to practice incorporating empowering messages within stories written for a younger audience and discussing the impact of how socioeconomic disparities found in low income communities hinder children's psychological and academic growth. Combining our knowledge of and experience in writing books for pediatric patients and working in low income healthcare communities both locally and abroad, we designed weekly lectures, reading and writing assignments, discussion questions, and in-class activities that encompassed these themes. Importantly, we designed a final project that resulted in students writing and illustrating original story books with a positive messages, to be printed and distributed to low income communities locally and abroad for children in these communities to read and enjoy.

| Princess Pe |

Major: Psychology - Biological
Mentor: Eva Schepeler
Research Type: UHP Project

University Honors Program Mental Health Initiative

The state of mental health among college students is an issue that has been thoroughly studied in recent years after increased public awareness. What is lacking, however, is research specifically on honors students' mental health which we suspect is uniquely at risk because of the high expectations to succeed placed on them by themselves and others. This study aims to shed light on this issue by administering a survey to students in the University Honors Program (UHP) at UC Davis asking students about their UHP experiences, their mental state, and their knowledge of campus mental health resources. The preliminary results of this investigation suggest that honors students are stressed about honors classes, lack of support from UHP staff, and program requirements (i.e. GPA). The ultimate results of this survey will be used to produce a series of mental health workshops for honors students and will provide insight to UHP staff on how to best support students in UHP. Overall, these results will serve as a starting point for shifting the culture surrounding mental health in honors students, so that future UHP students will be better prepared to manage their stress and consistently prioritize their mental health.

| Adnan Perwez |

Major: Religious Studies
Mentor: Mairaj Syed
Research Type: Thesis in Major

An Endowment of Justice: Examining the Dynamism of the Political Agency of the Common People in Classical Islamic Thought

The conceptualization of the role of the common people and their political agency within classical Islamic thought has often been seen through prominent socio-political models of the day, which drew on pre-Islamic themes of imperial hierarchy, social reciprocity, and definitions of justice to construct an ideal Community. Yet the relative rigidity of these conceptualized models were nuanced and at times even countered by reformist thinkers present within the tradition, who could present a new imagination of the role common people should play. This project specifically focuses on helping examine the imagined political agency of the common people, and thereby different conceptualizations of the ideal Community at large, by exploring the tension and alignment between prominent socio-political models present throughout Islamic history with the works of prominent classical reformist thinkers like Al-Ghazali and Ibn Taymiyyah. In addition to pursuing the core thematic idea of the common people's political agency through the lens of this framework, the project examines potential common trends that gave rise to these particular moments of reformism — raising a set of questions on the larger underlying tensions within the tradition, that can point the way for future research examining the different conceptualizations of the Community.

| Kelley Phan |

Major: Political Science
Mentor: Ethan Scheiner
Research Type: Thesis in Major

Political-Religious Landscape: Conditions and Patterns

Each country has their own unique relationship between politics and religion. This relationship can promote a high or low level of political restrictions on religion; affecting the amount of influence a religion may have within a country's political institutions. Naturally, a country's history and number of religious groups take part in this relationship. However, countries, such as the Egypt and Mali, with similar levels of religious diversity do not have the same levels of political restrictions placed on religion, but what seems to differ between these countries are their levels of development. What then affects the level of religious influence within a country's political institutions? Using data from the Religion and State Project, the World Religion Project, and United Nations Human Development Report, I conduct a quantitative analysis that studies whether a relationship exists between a country's level of religious diversity, human development and political restrictions on religion. Initial findings suggest that countries with low development will have less political restrictions on religion if their population is less diverse. With these results, further studies in this area can more accurately predict under what conditions will a country have more or less religious presence in their political and everyday lives.

Chesna Pokharel

Major: Psychology
Mentor: Simona Ghetti
Research Type: UHP Project

Associations Between Breastfeeding Duration and Early Language Ability

The American Academy of Pediatrics recommends six months of exclusive breast feeding; however, according to the CDC only about 50% of US babies are breastfeed after six months of age (1). Infants that consume breastmilk for longer in early life have shown to have higher language ability in middle childhood (2). We expected that children with longer durations of breast feeding will have better vocabularies and language ability regardless of age, formula supplemental feeding, and mother's education level at age 2. We conducted an observational study of 22 children ranging from 24-35 months of age. Breast feeding and language ability data were assessed via parent-reported surveys. We conducted a multiple linear regression to predict language ability based on duration of breast feeding and child age. Our regression equation was not significant ($F(1,18) = 1.06$, $p = 0.37$, $r2 = 0.005$). This indicates that child age and breastfeeding duration are not sufficient predictors of language ability in toddlers. Currently, the results are nonsignificant. Our sample consists of families that were primarily white, upper-class, and well-educated families. We anticipate with added diversity to the sample (data collection is on ongoing), that these differences may emerge.

Lindsey Popken

Major: Anthropology
Mentor: Gwen Arnold
Research Type: UHP Thesis

Cuddle Party! The Use of Sea Otter Narratives by Pacific Coast Wildlife Sanctuaries to Further Marine Conservation

This research study examines the use of sea otter narratives by seven Pacific coast wildlife sanctuaries. Exploratory research was conducted using qualitative and quantitative data to determine how sanctuaries were using sea otter narratives, and the most frequently used platforms to deploy said narratives. The study tests the hypothesis that northern Pacific coast wildlife sanctuaries deploy more sea otter narratives than their southern counterparts. The results show that that Pacific coast wildlife sanctuaries use narratives to further sea otter and ocean preservation primarily through information about oceanic degradation, humor, and aquarium information-related narratives. Narratives tend to rely on the charismatic nature of the sea otters and their contributions to marine environments, while hooking the audience into returning to the data source and wildlife sanctuary. As anticipated, northern wildlife sanctuaries appear to use sea otter narratives more frequently than southern ones. The study's findings ultimately demonstrate the value that sanctuaries can derive by utilizing a species that is admired by the general public to foster interest in environmental issues and conservation efforts.

Mira Pranav

Major: English
Mentor: Giovanni Peri
Research Type: Thesis in Major

Dealing in Discounts: Second-Degree Price Discrimination and Competition in the Brazilian Rental Car Industry

Linear-pricing models suggest that average prices in a market fall when competition increases. But, firms have also been found to engage non-linear pricing strategies (i.e. price discrimination) to try to maximize profits. The current literature shows contradictory findings when it comes to determining competition's effect on the way firms engage in price discrimination. My study will look at this relationship between competition and price discrimination in local Brazilian rental car markets. Specifically, I study two types of second-degree price discrimination strategies: quantity discounts ('more for less' deals) and quality discounts ('upgrade for a fraction of the price' type deals). The Brazilian rental car market is a useful empirical environment because it offers both of these discount strategies, as evidenced by data collected through web-scraping. Using regression analysis and the Boik and Takahashi (2018) model as my theoretical framework, I find that as competition increases there is no effect on quantity discounting, while quality discounting increases.

Aidan Sandhoefner

Major: Cognitive Science, Neuroscience Emphasis
Mentor: Simona Ghetti
Research Type: Thesis in Major

Talking About Thinking: Associations Between Parental Mental State Language and Toddlers' Uncertainty Monitoring

Uncertainty monitoring, a form of introspection, involves the ability to experience uncertainty when making inaccurate decisions. Parental use of mental state language (MSL) may be relevant for early development of this capacity. MSL includes reference to relevant concepts such as thinking, knowing, certainty and guessing. Despite its apparent relevance, little research has explored connections between parental MSL usage and children's uncertainty monitoring. This study aims to discover whether exposure to parental MSL contributes to toddlers' ability to report stronger uncertainty for their inaccurate compared to their accurate responses. In this experiment, 111 2-year-olds were narrated a wordless storybook by their parent whose speech was transcribed and coded for MSL terms. The toddlers returned at age 3 and performed a perceptual discrimination task requiring them to identify a target image from two partially degraded images and explicitly remark on their confidence. We predict higher levels of parental MSL at age 2 to predict children's uncertainty monitoring at age 3 (i.e., higher uncertainty for incorrect compared to correct responses on the perceptual task). This study impacts the fields of Psychology and Linguistics by contributing further insight into the effects of parental language on child cognitive development.

Priyanka Sanghavi

Major: Cognitive Science
Mentor: Richard Robins
Research Type: Thesis in Major

Development of Optimism Across the Lifespan

In this research, we examine the developmental trajectory of optimism in young adulthood to old age. We are comparing the trajectories of men and women, single parents and married parents, and US-born and Mexican-born adults. We are also examining how positive and negative life events affect the development of optimism. Additionally, we want to know if there are any similarities or differences between the trajectories of the two facets of optimism: expecting positive things in the future (positive optimism), and an absence of expecting negative things in the future (pessimism). We are using data from an optimism questionnaire in the California Families Project, which is a longitudinal data collection project focusing on Mexican-American families. For both men and women, we found inverted U-shaped curves in their optimism trajectories, and we found that positive life events have a stronger effect on optimism than negative life events. We found that positive optimism follows an inverted U-shaped curve, whereas pessimism declines over time.

Samuel Seaver

Major: Music
Mentor: Laramie Taylor
Research Type: Thesis in Major

The Threshold of Influence: Social Media & Music

Since 2015, online streaming services and social media platforms have taken over as the predominant mode of music consumption. This medium is abound with social information in the form of streams, likes, and shares, each contributing toward the perception of song success. Because there are prominent companies that deal with social media marketing, it is imperative to understand if higher quantities of likes are in and of themselves influential. In an online experiment, I examined social media "likes" as a factor predicting perception and selection of new music online. Participants were presented with a series of social media posts, each of which proffered a new song with a manipulated quantity of likes; a participant might see a song endorsed by dozens, hundreds, or thousands of peers before indicating interest in listening to that song. Results are discussed in terms of theoretical and practical implications of the effects of perceived social endorsement. The implication of this could lead to an unfair marketplace in which success can be manipulated by those who have power to increase a song's quantity of likes.

Kaytlin Smith

Major: English
Mentor: Maggie Morgan
Research Type: UHP Project

Designing *Evita*

For my project, I chose to design a production of *Evita* for the research required in order to replicate 1950s designer garments and accurate historical military garments. Having mostly designed American-based costumes previously, finding mid-20th century Argentinian garments for both casual and military wear proved to be a major task. Alongside that, couture garment construction tends to majorly differ from home sewing or storebought techniques, so understanding how Eva Peron's Dior gowns came together was another problem to solve. To understand my project, I delved into books of historical costume construction as well as online research to properly design the garments I designed. By choosing to learn not only the general size and shape of specific garments, but the construction and patterns as well, I found it much easier to understand how to create effects found on many of Eva's clothes. Sketching the designs several times over also helped me fully grasp the details needed fully set the garments in the era of the show. The end result was a full set of costume sketches that accurately represent the location and era *Evita* is set in, as well as a deeper knowledge of mid-century garments and cultural context of many outfits.

Paige Snelgrove

Major: Psychology
Mentor: Simine Vazire
Research Type: Thesis in major

What are the Quality Indicators of Journal Articles?

The quality of journal articles can vary substantially even within peer-reviewed journals. Therefore, it is important to understand what the quality indicators of articles are so that consumers of research can better assess articles. Additionally, identifying which aspects of an article that are not related to quality, even if commonly thought to be, is useful so that consumers can adjust their evaluative standards accordingly. To study these indicators and aspects, the sample size, article title, and the prestige of the authors' institutions were collected for 687 articles published within a psychology journal. These articles were also ran through Statcheck, a program that identifies inconsistencies in statistical reporting. Further, the Altmetric scores, a score that indicates how much attention an article has received online, were collected. With these data, we can investigate whether indicators at times thought to be related to quality, such as Altmetric scores and the prestige of the authors' institutions, are related to other indicators of quality such as sample size and consistency in statistical reporting. The current study's findings will help inform scientists about which indicators to prioritize to produce high quality articles and may provide journals with information that can help them better evaluate manuscripts.

Cathryn Snyder

Major: Cognitive Science
Mentor: Georgia Zellou
Research Type: UHP Thesis

Phonetic Imitation of Digital Devices and Human Voices Correlated With "Autistic" Traits

Research shows people often vocally align with, or imitate, the fine-grained speech characteristics of each other's voices while talking. The reason for phonetic imitation has been empirically associated with individual differences across people (i.e., personality and cognitive processing style), and people's natural tendency to promote successful social communication through implicitly matching their speech with the other speaker. Although there is research exploring human-to-human interaction and imitation, there is relatively very little research conducted to examine human-to-digital device interactions. The present study explores how individual differences, detected by the Autism-Spectrum Quotient questionnaire, influence the way humans interact with digital devices. In the current study, subjects performed a word shadowing task. We then assessed the degree of vocal alignment between the participants and four distinct interlocutors: two digital devices (i.e., Apple's SIRI) and two human voices. Subjects then filled out the self-administered Autism-Spectrum Quotient questionnaire. The results of the word shadowing task were then correlated with the results of the Autism-Spectrum Quotient questionnaire. The findings can yield new insight to the way humans interact with digital devices.

Genevieve Tikasingh

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

A Sociophonetic Analysis of the /a/~ /æ/ Vowel Merger in Trinidadian English

Trinidad and Tobago is the southernmost country in the Eastern Caribbean and represents a linguistic site in which both a mesolectal English Creole and a local standard variety of English exist. Recently, research on Trinidadian phonology has proposed an ongoing merger between the mesolect and the local standard (Youssef and James, 2008). Similar research has documented a number of ongoing vowel mergers, including that between the two variants of the TRAP vowel, /a/ and /æ/, of which /a/ has typically been considered more characteristic of the mesolect and /æ/ more closely associated with the local standard variety. This study investigates the proposed TRAP vowel merger in the speech of local radio show hosts, interviewees, and one call-in speaker in Trinidad. Both the proposed /a/~/æ/ merger and the potential for /a/ to be raised to /a̝/ are considered. The specific research questions are: Are /a/ and /æ/ merging in normalized vowel space? Is /a/ being raised to /a̝/? Eighteen tokens of the TRAP vowel for each of 12 speakers from two radio stations in Trinidad were analyzed using Praat and the DARLA suite of semi-automated vowel alignment and extraction tools. The resulting vowel extraction data from this study are compared with the vowel systems of 36 speakers of AAVE, Gullah, and Caribbean Anglophone Creoles from the 1840s–1990s documented in Thomas (2001). Whereas /æ/ in the speech of African Americans in Thomas' chapter occupies a distinct vowel space that is higher and fronter, the data within the current study show /æ/ to be realized lower and farther back in the mouth, and therefore closer to /a/, than has typically been considered characteristic of /æ/. Results from the current study therefore suggest that a merger between /a/ and /æ/ may in fact be occurring in Trinidadian radio speech.

Ashley Takeshita

Major: Pharmaceutical Chemistry
Mentor: Qizhi Gong
Research Type: Thesis in Major

Pathogen Recognition in the Olfactory Neuroepithelium

Olfactory epithelium (OE) is constantly exposed to environmental pathogens. Olfactory sensory neurons (OSNs) in OE project their axons into the brain, providing a direct route for pathogen invasion. Whether or not OE has the ability to recognize and respond to environmental insult remains unknown. Our lab used RNA-sequencing to identify gene expression changes in OE after vesicular stomatitis virus (VSV) exposure and regulation of selected cytokine expression. To test the hypothesis that sus cells, a layer of supporting cells at the surface of OE, can recognize pathogens, we examined the expression and cellular localization of the key pathogen recognition signaling factor, myeloid differentiation primary response protein (Myd88). RNA-sequencing data and qRT-PCR validated upregulation of the Myd88 gene in OE at 24 hours after VSV exposure. Immunohistochemistry shows Myd88 signal in the microvillar layer of sus cells. Double labeling with the OSN marker, Olfactory Marker Protein (OMP), and a transgenic reporter mouse line that labels sus cells will confirm cell-type specific expression. Future in situ hybridization experiments will further define Myd88 expression. Localizing Myd88 expression will provide insights into the innate immune responsive capacity in OE and aid in preventative strategies against pathogen spread into the brain via the olfactory nerve.

Ivan Urena-Valdes

Major: International Relations
Mentor: Heather Elko Mckibben
Research Type: Thesis in Major

Hosting or Boasting? Mega-Sporting Events and Globalization

International sporting events, like the Olympic Games and FIFA World Cup, are some of the largest gatherings of international citizens in the world. After securing the right to host, countries often undertake infrastructure projects, face pressure from the international community, and engage in multi-billion dollar business deals with corporations. In my research, I continue to explore the relationship between international sport and globalization by asking whether these events influence the extent to which a host nation is globalized, and whether globalization within a country has an influence on a country's decision to host. Looking at host countries from 1970 - 2016 for the Summer and Winter Olympics and FIFA Men's World Cup, I calculate the average values and changes in the KOF globalization index ten years before a host country is selected, six years leading up to an event, and in the six years following an event. I also do this for countries who attempted to host and countries within the host's region, using t-tests to compare the groups across different timeframes. By making these comparisons, I assess whether host countries are fundamentally different in their levels of globalization surrounding these mega-sporting events in comparison to these other groups.

Heather van Buskirk

Major: Sociology: Comparative Studies & World Development

Mentor: Ryan Finnigan

Research Type: Thesis in Major

Effect of Livelihood Diversification on Extreme Poverty Across Seven Sub-Saharan African Nations

Extreme poverty is a persistent problem in Sub-Saharan Africa, affecting the wellbeing of over 400 million people. Most of the extremely poor in the region live in rural areas, and although conventional wisdom has assumed that most of these households subsist through agricultural production on their own smallholdings, empirical research finds that many of these households have multiple income sources. This study examines the effect of livelihood diversification as an extreme poverty reduction strategy. Using the FAO Small Family Farms Dataportrait, I test the hypothesis that increased household livelihood diversification (i.e., off-farm income) is associated with lower extreme poverty (households living on less than $1.90 PPP per person per day) across seven Sub-Saharan African nations. Through multivariate logistic regression, I find that the odds of extreme poverty for diversified households compared to mainly agricultural households are lower by 73% across all countries. These results suggest that expanding the livelihood options available to poor households will be more effective in combatting extreme poverty than interventions focused on the agricultural sector alone.

Walter Woodard

Major: Economics

Mentor: Andre Boik

Research Type: UHP Thesis

Diversion Ratios and Pricing in Soft Drink Markets

Diversion ratios measure the fraction of consumers that switch to a different product—their second choice—after a price increase in their first choice. Diversion ratios are a central part of merger analysis between companies that produce similar products as they help the antitrust authority to determine if a proposed merger is to the detriment of consumers. This paper uses pricing, sales, flavor, brand and quantity data collected by Dominick's Finer Foods for the University of Chicago between 1989 and 1994. The data is sorted by eliminating irrelevant information, including other companies and resulting in a shorter period of time needed to estimate demand systems for Coca-Cola and Pepsi. These demand systems are then paired with the collected data to estimate diversion ratios for the two companies. The fact that the companies make such similar products suggests that diversion ratios will be relatively high, and a merger is unlikely to be allowed between the two.

Andy Wu

Major: Computer Science

Mentor: Xin Liu

Research Type: Thesis in Major

Radiation Oncology Research Paper Recommender System

Ethanol amines are a rapidly growing global market, used traditionally in absorbents, but recently expanding into detergents, cosmetics, and more. They are made by reacting ethylene oxide and ammonia to create MEA, DEA, and TEA, which each have unique uses and market space. Our investigation centers around designing a grassroot plant capable of producing at least 150 million pounds of ethanol amines and able to adapt to market trends and maximize production of any of the three, while also being safe and sustainable. To do this, we optimized the process so that product fractions can be adjusted by manipulating the feed ratio and recycle streams. In addition, we tried to limit overall costs by minimizing the sum of operating and capital costs of the different unit operations in a process that is flexible in terms of production ratios, while still achieving a high purity of each pro. We will assess our design by the ability to meet design requirements, while maintaining profitability by comparing product sales to all associated costs, including but not limited to operating costs, capital costs, utilities cost, and feedstock costs.

Jiayin Yang

Major: Computer Science

Mentor: Carl Stahmer

Research Type: UHP Project

A Computer Vision Approach to Make Broadside Ballads of Seventeenth Century Accessible as Text, Art, Music, and Cultural Records

Broadside Ballads were a product printed on one side of poor quality paper with eye-catching illustrations and alluring poems in 17th-century. In 2003, when people planned to research on street literature with a focus on broadside ballads, they found the access was blocked, since original editions were guarded, and copies were difficult to locate and read. Here, we proposed to address the problem by developing the software that visualized all ballad images in a two-dimensional projection within which similar images were clustered together. We did this by utilizing SURF and other Computer Vision algorithms to compute similarity network of all images and classify them based on distances. Then, we applied the TSNE algorithm to generate coordinates for each image for three-dimensional layout and utilized OpenGL library to build the website. The resulting website successfully visualized and cataloged 16034 ballad images. This project paves the way for a content-based search and retrieval platform for digital archives of other historical printed materials.

College of Engineering

| Kiran Bhadury |

Major: Computer Science and Engineering

Mentor: Xin Liu

Research Type: Engineering Design Project

Gamification of a Nutrition Literacy Mini-course

Poor nutrition literacy is prevalent among low-income college students. This project aims to teach students about health and nutrition with educational computer games that will be included in an online mini-course. In addition, the games will record data on student performance for teachers.

| Sam Lee |

Major:Computer Science and Engineering

Mentor: Xin Liu

Research Type: Engineering Design Project

Gamification of a Nutrition Literacy Mini-course

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| Justin Mulvey |

Major: Materials Science and Engineering

Mentor: Van Benthem

Research Type: Engineering Design Project

Photothermal Projection Lithography: A New Approach to Patterning Organic Semiconductors

Thin film organic semiconductors (OSC) are widely studied for applications in organic thin film transistors (OTFT), organic photovoltaics (OPV), and organic photodetectors (OPD) because they are lightweight, flexible, and compatible with inexpensive roll-to-roll processing. One challenge for mainstream implementation of OSC devices is the difficulty in patterning the surface of devices. Traditional inorganic patterning methods such as soft lithography or photoresist-based projection lithography are unable to consistently produce submicron scale surface patterns. Our group is designing a new patterning technique known as photothermal projection lithograph. In this method, a laser is used to locally heat a solvent-swollen polymer film submerged in a theta solvent. The laser increases the temperature enough to induce dissolution of the irradiated polymer and thereby creates a patterned polymer with diffraction limited resolution. Before photothermal patterning can be implemented for industrial-scale large-area patterning of OSC devices, a better understanding of the process is required. Here, etching rate is studied as a function of light intensity and organic solvent composition using thin films of poly(3-hexylthiophene) (P3HT). The relationship between laser intensity, dwell time, irradiation wavelength, solvent quality, and patterning depth are studied to obtain reproducible patterning parameters. This new process will enable large-area submicron OSC patterning aimed at industrial application.

| Riley Cliff |

Major: Mechanical Engineering

Mentor: Steven Velinsky

Research Type: Engineering Design Project

The No-Tiller: A Machine Assist for Installing Landscape Fabric

The objective of this project was to develop a machine to streamline the procedures used in no-till agriculture without employing fossil fuels. No-till agriculture is an alternative farming method that involves laying down compost over crops, then covering both with landscape fabric that is subsequently secured to the ground. Our sponsor currently carries this process out by hand, laying down the landscape fabric and pressing staples down through it and into the ground. However, this process is rather time-intensive, and requires a significant amount of human labor. By creating a device to carry out the same process, the amount of human effort required is significantly reduced, and the procedure becomes readily scaled to different farm sizes.

| Jaime Luo |

Major: Civil Engineering

Mentor: Colleen Bronner

Research Type: Engineering Design Project

Optimizing UV Disinfection Design with Computational Fluid Dynamics

During large rainfall events, the ultraviolet (UV) disinfection system at the UC Davis Wastewater Treatment Plant (WWTP) is unable to maintain the minimum UV transmissivity (UVT) mandated by its discharge permit. Wastewater effluent with a low UVT is not permitted for beneficial reuse because it is believed particles harbor pathogens and interfere with disinfection. A site-specific biological assay was performed at the WWTP to assess the disinfection efficiency of the UV system under various UVT conditions. Computational fluid dynamics software was also used to design an optimal UV reactor to replace the aging system.

| Natalie Stucka |

Major: Biomedical Engineering

Mentor: Jennifer Choi

Research Type: Engineering Design Project

CoagID: Nuclear Magnetic Resonance (NMR) Measurement of Coagulation

Coagulation is a physiological process in which blood undergoes biochemical changes to prevent blood loss by forming a gel-like clot. A variety of methods exist to measure a patient's coagulability; however, these tests are insufficient as they have long run times, can only be run in a lab, or have high user variability. These deficiencies have direct impacts on patient care decisions. For example, each year one million trauma patients present with a life-threatening imbalance of blood components, which can lead to death within a few hours of injury. This condition cannot be properly treated without rapid, reliable coagulation testing. Therefore, there is a need for a technology that can measure coagulation and provide real-time metrics to guide patient care. Nuclear magnetic resonance (NMR) relaxometry provides real-time measurements on the chemical and physical properties of materials, such as viscosity, proton density, and protein composition, all of which change during coagulation. NMR is a viable method for measuring coagulation; however, the changes in NMR signaled during blood clotting have not been extensively studied. To address this, we developed an investigational device "CoagID," which maintains the coagulating blood sample at physiological temperature and continuously acquires NMR data, while allowing for modulation of experimental parameters.

| Alex Williams |

Major: Chemical Engineering

Mentor: Jason White

Research Type: Engineering Design Project

Market Reactive Design for Ethanolamine Production

Our project is a software tool designed to help Radiation Oncologists make treatment recommendations for cancer patients. Radiation Oncologists attempting to make treatment recommendations for a disease site they are unfamiliar with can spend a significant amount of time finding research papers relevant to the specifics of the tumors they are trying to treat. Our project aims to streamline the process of literature review through the application of machine learning and natural language processing. We are developing a general framework that will allow researchers to train machine learning models suited towards their particular area of research. This work will be applied specifically in the domain of radiation oncology to aggregate and filter research papers for use in a treatment recommendation tool that would provide oncologists with an easier, more centralized and faster way to review the medical literature necessary to make treatment recommendations.