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# **32ND ANNUAL UNDERGRADUATE RESEARCH,** SCHOLARSHIP & CREATIVE ACTIVITIES CONFERENCE

April 28 - May I, 2021

# 32<sup>nd</sup> Annual Undergraduate Research, Scholarship and Creative Activities Conference

# Letter from the Chancellor

April 28, 2021

Dear Students, Colleagues and Guests:

On behalf of UC Davis, it's my pleasure to welcome you to the 32nd Annual Undergraduate Research, Scholarship and Creative Activities Conference!

UC Davis is one of the top research universities in the nation, with globally leading programs in agriculture, veterinary medicine, environmental science, healthcare and more. Our scholarship and research addresses some of society's most critical challenges, including climate change, feeding the world and sustaining the health of all living beings.

Student researchers are at the heart of the research enterprise. They represent a wide variety of fields and are critical to building a better tomorrow.

Through this conference, we are preparing our students to move into the future with confidence and creativity. We are providing and showcasing educational opportunities that prepare students for career success. Many employers are looking for talented people

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who not only shine in their research and scholarship, but also have the capacity to collaborate and communicate their work in the most impactful manner possible. In addition to the skills developed during research, these oral and poster presentations are a great form of practice as our students prepare for graduate school and the workforce.

Our students are currently facing an environment like no other, amid a pandemic that has changed every facet of daily life. Yet they still maintain their passion for their research and desire to participate in a virtual conference. Our students continue to demonstrate their ability to problem solve and adapt to any situation.

I congratulate the student presenters for their dedication and excellent work thus far. They have partnered with faculty mentors and peers in a spirit of collaboration and discovery. Now, they can share their work with experts in their fields and our UC Davis community.

I want to thank the Undergraduate Research Center for organizing this important conference and connecting students with important research opportunities, programs and awards. I also want to recognize our faculty members, who serve as mentors and role models for students. Your collaboration and mentorship with students bring out the very best in UC Davis, and your work helps prepare them for future success. Finally, I extend my gratitude to the many faculty volunteers and staff who serve as moderators for the conference sessions. This is exactly the kind of thoughtfulness and synergy between students and faculty that defines UC Davis.

I wish everyone a great conference and thank you for bringing out the best in our university.

Gary S. May Chancellor

# ACKNOWLEDGMENTS

The Undergraduate Research, Scholarship & Creative Activities Conference gratefully acknowledges the faculty sponsors and other individuals whose mentoring has contributed to the research produced by our presenters. We would also like to thank the many programs that generously support and encourage undergraduate research and creative activities at UC Davis. Among these are the following: Beckman Scholars Program; California Alliance for Minority Participation (CAMP); Educational Enrichment Outreach Programs (BUSP, BUSP-Honors, BSHARP-MARC, CURE, ADAR); Internship and Career Center; McNair Scholars Program; Mentor-Mentee Program in Humanities, Arts, Cultural Studies and Social Sciences; Mentorships for Undergraduate Research in Agriculture, Letters and Science (MURALS); Mentorships for Undergraduate Research Participants in the Physical and Mathematical Sciences (MURPPS); Provost's Undergraduate Fellowship: University Honors Program; UC Davis Washington Program; UC Leadership Excellence Through Advanced Degrees (UC LEADS), and Vertically Integrated Projects (VIP).

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#### Comparison of Machine Learning Models for Image Classification

*Mehita Achuthan* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The purpose of this project is to teach UC Davis's first CubeSat when to collect pictures and IR sensor data. The Space and Satellite Systems (SSS) Club has developed a CubeSat that lays the foundation for low cost missions focused on Earth Science. This mission objective relies heavily on the problem of when to collect data and ensuring the quality of our data. This is accomplished through machine learning and information theory and processing by the Computer Systems Team of SSS. After dedicated research, we have compared and contrasted three methods for teaching our CubeSat: Linear Regression, Logistic Regression, and Support Vector Machine. Our results were verified with mathematical optimization. We are developing a novel data set, which is highly sought after in Machine Learning research, to further test our methods. Future work will include a novel method that will not only teach the machine, but allow it to actively learn at low cost to our power systems.

#### The Influence of Climate Variables and Disease on *Plantago lanceolata* Survival

*Lilly Ackerman* Sponsor: Jennifer Gremer, Ph.D. Evolution & Ecology

This project is a continuation of a study on the globallydistributed perennial plant Plantago lanceolata that has been conducted annually since 2016. Studying global P. lanceolata populations in relation to climate change helps to inform the development of persistence models. The protocol of Plant Pop Net, an international project, was used to execute our study. Plant Pop Net aims to comprehend the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the globe. At our site in Davis, CA, we measured the abundance and phenotypic traits of P. lanceolata for five years. Data collected includes leaf length, inflorescence length, disease presence, and other phenotypic traits. We would like to investigate the influence of climate variables and disease on plant survival. Using compiled data, we will look at variation in precipitation and temperature to see if there is a correlation with yearly plant survival. In addition, yearly survival will be compared to the proportion of plants containing disease. We predict that individuals with disease will experience reduced survival compared to those without. Further, we expect higher precipitation and temperature to result in increased survival.

# First There Was Nothing, Then...Luminescence: The Isolation of Individual [(C<sub>6</sub>H<sub>11</sub>NC)<sub>2</sub>Au]<sup>+</sup> lons in Crystals and Their Formation of Benzene Solvates

#### Alexandria Adams Sponsor: Alan Balch, Ph.D. Chemistry

Studies have shown that the two-coordinate cation,  $[(C_6H_{11}NC)_2Au]^+$ , self-associates with the anions  $(AsF_6)^-$  and (SbF<sub>6</sub>)<sup>-</sup> to form luminescent crystals that contain linear chains of cations and display unusual polymorphic, vapochromic, and thermochromic properties. The interest in developing these types of environmentally responsive, luminescent metal-organic compounds can be useful in areas of temperature sensing, biological imaging, and metal toxin detection. Different ways to isolate  $[(C_6H_{11}NC)_2Au]^+$  ions from one another through the formation of non-luminescent crystalline salts have been investigated. It has been found that the crystallization of  $[(C_6H_{11}NC)_2Au]EF_6$  (E = As, Sb) from benzene solution produced colorless, non-luminescent crystals of the solvates  $C_6H_6$  . [(C<sub>6</sub>H<sub>11</sub>NC)<sub>2</sub>Au]EF<sub>6</sub>. These solvates lose benzene upon standing in air, and in turn produce green luminescent ([(C<sub>6</sub>H<sub>11</sub>NC)<sub>2</sub>Au]AsF<sub>6</sub>) or blue luminescent ([(C<sub>6</sub>H<sub>11</sub>NC)<sub>2</sub>Au]SbF<sub>6</sub>) powders. Further investigation of these crystals involves mixed amounts of anions during crystallization, as well as the anion  $(PF_6)^{-}$ , exploring different properties of their conversion from a benzene solvate to a powder.

# Expression and Function of Sox10 During Neural Crest Cell EMT

*Carly Adamson* Sponsor: Crystal Rogers, Ph.D. VM: Anat Physio & Cell Biology

Neural crest cells are embryonic stem cells that transition from a tightly adherent epithelial sheet to migratory and invasive mesenchymal cells. The epithelial to mesenchymal transition (EMT) is a crucial process in which neural crest cells gain the ability to migrate out of the neural tube to become diverse derivatives (craniofacial bone, pigment, neurons) in the developing organism. Here, we study the molecular mechanisms within and across species that drive the development and EMT of neural crest cells. Using immunohistochemistry, we characterize differential expression of Sox10 in relation to other neural crest factors, Sox9, Snai2, and Pax7, across multiple developmental stages in developing chicken and quail embryos.

Further, we perform loss- and gain-of-function studies to determine if Sox10 is necessary and/or sufficient to drive the process of EMT. Our initial findings show that in chick embryos, Sox10 knockdowns reduce the neural crest cell population while Sox10 overexpression results in the gain of neural cadherin and Sox9 at the expense of epithelial cadherin and Pax7 expression. Future work will focus on horizontal integration efforts and understanding the direct and indirect role of Sox10 during EMT and determining if its function is conserved between species.

#### Investigating Interfering Electric Fields Phenomenon to Stimulate Specific Regions of the Rat Brain

# *Muhammad Afaq* Sponsor: Min Zhao, M.D.,Ph.D. MED: Dermatology

In brain stimulation therapy, Electric Fields (EF) are distributed in conductive and nonconductive brain regions and inefficiently stimulate cells. This leads to brain cells not responding to EFs. Stimulating specific brain regions with certain frequencies can induce cellular response. This is achieved by stimulating the brain with two EFs and causing interference which can stimulate a specific region in the brain. The purpose of this study is to form a more solid understanding of how Interfering Electric Fields (IEFs) behave in rat brains and how targeted stimulation can be achieved from that understanding. This is accomplished by running computer simulations with IEFs on rat brain atlases generated from MRI and NissI histology. The simulation results will be validated with experiments in which IEF behavior is studied in cell cultures. The cell culture, when stimulated, induces a proliferation response which is viewed by conducting immunofluorescence staining. IEF behavior will then be observed in organotypic rat brain cultures which consider the three-dimensional architecture and different layers of the brain. In conclusion, we studied how IEFs behave in rat brains using different techniques to achieve targeted brain stimulation. This understanding will help improve brain stimulation therapy of diseases like Parkinson's and Alzheimer's.

### The Impact of COVID-19 on the Mental Well-Being of the Asian Pacific Islander American (APIA) Population Ages 18-30 Residing in Yolo and Sacramento, California

*Noor Akhter* Sponsor: Christian Bohringer, M.D. MED: Anesth & Pain Medicine

Coronavirus disease 2019, or COVID-19, is an infectious communicable respiratory illness that has affected over 100,000 people throughout Sacramento and Yolo County. During the pandemic, social distancing and lockdown measures were put in place to ensure the safety of our communities. Mental health issues have become relatively common in the youth group due to social isolation. Our aim is to investigate, to what degree has COVID-19 impacted the mental well-being of the Asian & Pacific Islander American (APIA) community, ages 18-30, residing in the Yolo County and Sacramento City/County, CA region compared to the Caucasian population? Our online survey asks participants to rate statements based on their mental health, healthcare access, and academic performances. Our survey was opened from January 20th, 2021 to February 3rd, 2021. Our sample group (n = 147) consisted of 32 participants identifying as Caucasian and 94 participants identifying as Asian/Pacifier Islander. Our data suggest that Caucasian and APIA communities are experiencing depressive symptoms. However, the APIA community reported having a higher impact of negative effects related to depression, anxiety, mood, and stress levels. In conclusion, there should be more resources to support the APIA community regarding their mental well-being, especially during this time.

# Effects of cover crop management through tillage or grazing on the metabolic diversity of the soil microbial community in a Mediterranean vineyard

#### Anthony Alameda Sponsor: Maria Lazcano Larkin, Ph.D. Land Air & Water Resources

Cover crops are used in vineyards to improve infiltration and mitigate erosion but require management to prevent competition with the vines. Tillage or sheep grazing are options to terminate cover crops but have tradeoffs by promoting or hindering soil microbial activity to different degrees. Soil microorganisms support decomposition and nutrient cycling thus, are responsible for supporting soil health. We established a field experiment in a vineyard to study the effects of cover crop management on soil microbial activity. Cover crop residue incorporation into the soil through tillage was compared to nontilled soils leaving the mowed cover crop on the soil surface; grazing effects were assessed using grazed versus non-grazed enclosures. Treatments were applied to 9.7 by 14.6-meter plots, with four plots per treatment. Three years after the trial set up (spring 2021), we collected soil samples at 0-15 cm and 15-30 cm depths. Biolog EcoPlates were used to assess changes in the community's metabolic profile. Higher microbial activity and metabolic diversity are expected within the grazed treatment and no-till treatment as the input of sheep waste provides nutrients and less disturbance occurring, respectively. Determining and implementing the best management methods can keep other vineyard soils equally sustainable for aenerations.

# Preliminary Validation of an Observational Measure of Emotion Regulation for Individuals with Fragile X Syndrome

Cameron Alexander Sponsor: Nicole Sparapani, Ph.D. Education

Emotion regulation (ER) is the combination of physiological, behavioral, and emotional states that provide the tools needed to adapt through everyday situations. Studies often measure ER using rating scales completed by a caregiver, potentially resulting in biased representations of ER. This study aims to examine the construct validity of an observational measure of ER outlined in the Classroom Measure of Active Engagement (CMAE). Participants included 29 males with Fragile X Syndrome between the ages of 15-22 who were recruited for a longitudinal study at the UC Davis MIND Institute. As part of the larger study, video observations of the Autism Diagnostic Observation Schedule (ADOS) were collected, and parents completed a battery of questionnaires to measure anxiety and behavior. Three trained raters coded ER using the ADOS observations; interrater agreement was high (88.87%). Findings indicated significant, positive correlations between emotion dysregulation and salivary alpha-amylase (sAA) readings (r = 0.622; p < 0.01), suggesting an association between ER and psychosocial stress expressed by the sAA recordings. The associations between ER with anxiety and behavior were not significant. These findings offer preliminary support for the validation of the ER construct outlined on the CMAE, and substantiate the role of physiological arousal in ER.

#### Bromide Effects on Pregnant Cattle and Parturition

#### Orli Algranatti Sponsor: Wilson Rumbeiha, D.V.M.,Ph.D. VM: Molecular Bio Sciences

Beef farmers feeding pregnant cattle bromide contaminated hay are perplexed by the increase of cows with dystocia at the time of parturition. There is a knowledge gap of effects of bromide in pregnant cows. In this investigation, we hypothesized that bromide causes dystocias. Pregnant cows are fed bromide in their third trimester of pregnancy to assess toxicity and later the health of the newborn calves will be evaluated. There are 5 study groups: Group 1, negative control, 0 ppm bromide (n=4). Group 2, 50 ppm bromide in total mixed ration (TMR) (n=4). Group 3, 200 ppm bromide in TMR (n=4). Group 4, 800 ppm bromide in TMR (n=4). Group 5, 3200 ppm bromide in TMR (n=4). Comprehensive physical examinations, including body weight is performed every 7-14 days. Serum bromide is evaluated on days 0, 30, 60, 90 and weekly after parturition for 4 weeks. Ultrasounds are performed monthly to assess the health status of the fetuses. Upon parturition, amniotic fluids will be collected for bromide level measurements. At necropsy, liver, kidney, and muscle will be assessed for bromide levels. 30 days into the study, preliminary results show no bromide effects on cows or fetuses.

# Activated Microglia Stimulate Neurodegeneration in Non-Human Primate Model of Alzheimer's Disease

Addison Ali Sponsor: John Morrison, Ph.D. MED: Neurology

Microglia are myeloid cells that sense invading pathogens and sustain brain homeostasis through trophic support. Microglia are suspected of playing a role in neurodegenerative diseases such as Alzheimer's disease (AD). We hypothesized that microglia mediate neuroinflammation and promote neuron death. To test this, we targeted the entorhinal cortex (ERC) in the brains of 6 rhesus monkeys. They received two injections of an adenoassociated virus expressing a double mutant tau known to cause tau-related pathology in humans (AAV-P301L/S320F, for simplification AAV-2xTau) in the left hemisphere, and similar injections of AAV-GFP in the right ERC as a control. Within 6 months, we observed extensive tau-based neuropathology, with clear evidence of propagation of tau fibrils, similar to what is hypothesized to occur in AD patients. Using immunohistochemistry, we observed intense microglia activation and neuroinflammation in the hippocampus of the injected animals, supporting the hypothesis that microglia play a major role in the degenerative process observed in AD. The areas with strong microglia activation corresponded with where tau pathology was the most prominent. Learning more about microglia activation and its connection with AD can further our understanding of how to treat or alleviate symptoms of the disease.

# What are the Roles of Pitch Variation and Word Repetition in Infant Vocabulary Development?

Mariam Ali Sponsor: Katharine Graf Estes, Ph.D. Psychology

Infant-Directed Speech (IDS), also known as baby-talk, is characterized by higher pitch, longer word duration, a wider pitch range, and more word repetition in comparison to Adult-Directed Speech (ADS). Prior research suggests that components of IDS affect infants' language learning. However, we do not yet know how certain linguistic elements, such as varying pitch and word repetition, contribute to infants' vocabulary development. The current study will investigate whether infant vocabulary size correlates with parents' pitch range and/or the number of target word repetitions the parent produces. We will analyze audio recordings of monolingual English-speaking parents playing with their infants (n= 24, ages: 10-12 months) in a task designed to elicit 14 target words (e.g., hat, apple, boat). We will count repetitions of each target word and measure the pitch range for these target words for each participant. We will collect infant vocabulary size via parental reports on a standardized vocabulary form. We expect that parents with high rates of target word repetition and wide pitch ranges will have infants with the largest vocabularies. If confirmed, these findings would suggest that certain characteristics of IDS can be targeted to promote better linguistic development in infants.

#### Child Challenging Behaviors and Symptoms of Autism Spectrum Disorder in Children with Fragile X Syndrome

Hala Alkhatib Sponsor: Leonard Abbeduto, Ph.D. MED: Psychiatry & Behav Sci

Fragile X syndrome (FXS) is the leading inherited cause of intellectual disability and is caused by a mutation in the FMR1 gene on the X chromosome. Male children with FXS often present with language delays, autism spectrum disorder (ASD), and behavioral challenges. However, the influence of FXS extends beyond the child to the greater family system. Parents are likely to experience elevated parenting stress, which may negatively influence relationships within the family and the child's development and behavior. The present study was designed to provide a fuller account of the possibility of differential impacts on mothers and fathers of children with FXS. We compared maternal and paternal ratings of child challenging behaviors using the Aberrant Behavior Checklist-2 (ABC-2) and ASD symptoms using the Social Responsiveness Scale-2 (SRS-2). Initial findings show that mothers endorsed higher ratings on the ABC-2 compared to fathers. Additionally, most parents rated ASD symptoms as moderate or severe. Despite these differences, there were strong and significant relationships between mothers' and fathers' ratings on both the ABC-2 and SRS-2. Future directions include investigating how these characteristics influence parents' well-being. Understanding the features that affect family relationships allows for the expansion of interventions dedicated to improving family well-being.

#### The Body's Role in Sufism

#### Sophia Allen Sponsor: Naomi Janowitz, Ph.D. Religious Studies

In Islam, the mystical tradition of Sufism is seen as an extreme yet effective way of coming into true union with God. Sufi Muslims renounce the world and its pleasures in order to seek a state of ecstatic, intoxicating joy. This state only occurs in encounters with their "beloved," a popular Sufi term for God. The experiences they describe liken to a kind of ego-deaththey become so aligned with God's being that their individual self ceases to exist. These divine encounters caused many Sufi's to speak ?as? God in the first person, asserting that the only true "I" is God. This intense identification with the Creator indicates that their individual self had melted away in His presence. Despite their unity with God, they remain on earth in the same physical bodies as prior to these events. This deep spiritual transformation prompts the question of how exactly the physical vessel factors into the complete obliteration of the self. My thesis will explore how the body functions as a site of convergence of finite human identity and God's infinite nature, and how exactly the body is affected or regarded in the aftermath of union with God.

# Robot Strawberries: Economic and Labor Implications of Automation in the Strawberry Value Chain.

# **CHRISTOPHER ALMARAZ** Sponsor: Marjorie Visser, Ph.D.

Human Ecology

For the last 50 years, the economics and labor relations in strawberry production have attracted significant interest from social scientists and economists. The demand for fresh strawberries continues to grow, but farm laborer availability falls short of demand. The farmers are seeking technology that can substitute for labor. Automation has already moved forward in mechanized mass crop harvestings such as tomatoes and, more recently, in apples and bell peppers. However, planting, picking, and packing strawberries has unique challenges because of their delicacy and the need for human beings to evaluate their ripeness. With the development of image recognition, Al, and increasingly sophisticated robots, previously considered manual tasks but non-routine are being threatened by automation made possible by digitization. This research will examine the economic and labor impacts of automation in the strawberry value chain and study the engineers and researchers contributing to the digitization process. Automation will affect each step differently and different workers differently. Further, after many years of development, several robots have successfully managed to replicate the human labor consistent with harvesting strawberries. This research seeks to discern the trends of automation in strawberry fields while also foreseeing implications for the laborers, sustainability, and the strawberry industry.

#### The Synergetic Effect of Analytical Theory, Numerical Methods, and Experiments With Regards to Bernoulli's Law

Faiza Alvi

Sponsor: Mohamed Hafez, Ph.D. Mechanical & Aerospace Engr

The purpose of this research project is to observe the synergetic effect of combining theory, numerical analysis, and experiments when explaining engineering concepts. It expands beyond the analytical theory by showing the efficacy of numerical methods in achieving the same results as the analytical theory with less effort. The physical experiments also play a crucial role-they illustrate the theoretical concepts on a tangible level that makes them simpler to both observe and understand. This project discusses Bernoulli's law for incompressible and compressible flow. The first experiment shows how Bernoulli's law can be effectively modeled for incompressible flow with simple household items. The other experiments model compressible flow in two ways; one which account for shock in a nozzle and one which does not. The experiments prove that while the numerical analysis does have some discretization error, it mimics the analytical results fairly accurately. The implications of this project are to illustrate how the gaps in theoretical analysis can be filled by using alternative techniques. In this case, physical experiments and numerical methods enrich the theoretical components of these concepts and show how the theory can be implemented on a practical application basis.

# Examining Speech Toward Alexa versus humans: A comparison of adults and children

Ava Anderson Sponsor: Georgia Zellou, Ph.D. Linguistics

Voice assistants such as Alexa and Siri are now commonly used in the home and everyday life, yet our scientific understanding of these interactions is still in its infancy. This study tests how people of different ages (college-age adults and children, ages 7-12) talk to an Alexa device versus a human. The interactions, conducted over Zoom due to social distancing restrictions, were controlled so that participants said the same sentences to the Alexa and human interlocutors. Subjects see a list of 24 words and, on each trial, the experimenter or device asks what the next word on the list is. The subject replies with the corresponding word on their list ("The word is pig"). Then, the experimenter or device says the word back and asks the subject to repeat the sentence; on 4/24 of trials, the interlocutor mishears the pronunciation, saying a second word with a consonant error ("I heard pig or pick"). Videos are annotated in ELAN and manually checked. We predict that adults and children will show differences in the way they adjust their speech for a human versus Alexa interlocutor. Broadly, this work can reveal the impact of voice assistants on language behavior across the lifespan.

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

### *Elizabeth Anderson* Sponsor: Matthias Hess, Ph.D. Animal Science

Ruminant livestock production is a major contributor to anthropogenic greenhouse gas emissions, particularly in the form of enteric methane (CH<sub>4</sub>) production. Enteric CH<sub>4</sub> is the result of microbial fermentation of feed within the foregut of ruminant animals. One promising strategy to reduce enteric CH<sub>4</sub> without compromising animal productivity is the dietary addition of plant material with anti-methanogenic properties. In recent years some agricultural byproducts, such as grape and pomegranate pomace, have shown CH<sub>4</sub> mitigation potential. In addition to reducing overall CH<sub>4</sub> emissions, rerouting agricultural waste from the landfill into animal production systems would reduce both total feed costs for livestock producers and the environmental footprint of food production. This project's objective is to evaluate regionally-generated agricultural waste products for their potential to reduce enteric CH<sub>4</sub> production using an artificial (in vitro) rumen system. I will present results from our screening efforts to evaluate the methane mitigating potential of byproducts from cherry, coffee, hazelnut, onion, pistachio, and walnut processing and from beer brewing. These results will provide first indications of which of these byproducts should be explored for their CH<sub>4</sub> reducing potential in vivo.

### A Comparative Study of Thyroid Hormone-Associated Regulated Gene Expression in the Xenopus Laevis Brain

*Allison Andre* Sponsor: John Furlow, Ph.D. Neuro Physio & Behavior

During brain development, thyroid hormone (TH) plays a vital role in regulating gene transcription via its two forms, T4 and T3, guiding processes that shape the brain for optimal function throughout the lifetime. Past research in rodent models sought to identify the TH signaling pathway components and regulated genes in the developing brain, but many of the specifics, particularly direct transcriptional targets of T3, remain unknown. The aim of this study was to use transcriptomic data from T3treated Xenopus laevis tadpole brains to characterize the gene expression profile in this amphibian model of TH action, in comparison to other vertebrates. As hypothesized, we found that many known regulators of TH, such as thyroid hormone receptors a and ß, deiodinases 2 and 3, retinoid x receptors a, ß, and  $\gamma$ , slc16a2, ncoa1, ncor1, and ncor2, were present in the Xenopus brain transcriptome. Additionally, we identified a handful of genes previously recognized as direct targets of TH in mammalian systems, most notably klf9. These results provide further evidence that TH signaling in the brain is conserved across species, and suggest the presence of a core group of genes that are consistently targeted by T3 amidst its otherwise broad array of transcriptional targets.

### lel, il, or elle? Gender Non-Binarity in French

#### Santhoshi Angadipuram Ramanathan Sponsor: Eric Iouis Russell, Ph.D. French & Italian

In languages with grammatical gender, people who identify out of the gender binary are given two choices: to use the grammatical male/female form or create a third gender-neutral option. With more people identifying as non-binary, there is a need for appropriate forms. My research examines the creation and use of gender-neutral language in French, focusing on social media. I began by gathering data from 5-10 French Instagram accounts that discuss LGBTQIA+ activism to see what changes are being proposed. The most frequent modifications were the use of iel/ael pronouns, alongside canonical il/elle. After pronoun usage, the most common information presented was about making nouns and adjectives gender-neutral. This mostly dealt with the written form, with next to none of these posts mentioning a way to convert this method to spoken French. After observing the writing forms used by most of these accounts, using a period to condense words with both masculine and feminine forms into one is the most common method, which would result in forms like médecin to become written like médecin.e. However, the aforementioned details are not uniform across accounts, causing confusion, and possibly lowering the usage of such writing in online spaces.

### Measuring the Effectiveness of Undergraduate Teaching Assistants to Analyze Differences in Instruction in Chemistry Laboratories

Xavier Antoine-Goeas Sponsor: Ozcan Gulacar, Ph.D. Chemistry

Beginning in Fall 2017, the Chemistry Department at UC Davis established a pilot program through which undergraduate teaching assistants, formally known as Emerging Scholars (ES), are introduced into laboratory settings to work alongside graduate teaching assistants (TA). To study the differences in student interactions with the TAs and the ESs, every TA and ES was asked to audio record their conversations during two lab sessions. After the audio data were collected, they were first transcribed, and student interactions with the lab instructors were coded using Laboratory Observation Protocol for Undergraduate STEM (LOPUS). Findings of this study will reveal whether students are more comfortable approaching TAs or ESs, and how the teaching styles may vary between the two lab instructors. Student inquiries and TA's or ES's responses will be carefully examined to better understand the instructional styles in the labs. These observations and analyses will reveal the efficacy of the Emerging Scholars program and provide insight on methods to enhance student learning experiences.

#### Effects of Milk Osteopontin on Bone Development During Infancy

#### *Lam Ao* Sponsor: Bo Lonnerdal, Ph.D. Nutrition

Osteopontin (OPN) is a multifunctional protein that has been identified in bone matrices and plays essential roles in bone development, including bone formation. OPN is also found in high amounts in human milk, which associates positively with bone development. With a high concentration of OPN appearing in mouse milk, effects of milk OPN on bone development during infancy were evaluated using our established OPN KO mouse model. Wild-type (WT) mouse pups were nursed by WT dams (WT group) or OPN KO dams (KO group) from postnatal day 1 to 21 (P1-P20). The effects of milk OPN on bone development were assessed in P20 mouse pups by ELISA and histological analysis. The results showed that WT and KO mouse pups had similar body weights, and tibia and femur lengths. Compared to the KO group, the WT group had higher concentrations of plasma OPN and P1NP (a marker for bone formation). Consistently, more OPN stained cells were found in the femurs of pups from the WT group than in those from the KO group. These results suggest that milk osteopontin is associated with developmental processes of the bone, including bone formation.

### Incidental Findings found on Abdominal Imaging performed for General Surgery Patients

#### Amanda Aquilio Sponsor: Michael Campbell, M.D. MED: Surgery

The use of computerized tomography (CT) imaging has increased, leading to a rise in the identification of incidental findings (IF). Inappropriate follow-up of IFs can lead to poor patient outcomes, delayed treatment and increased costs. The rate of patient awareness and follow-up of IFs has not been evaluated in patients admitted to an acute care surgery (ACS) service. We conducted a review of ACS patients with a primary care provider (PCP) admitted from January 2014 to December 2019. The aim of the study was to evaluate the incidence and rate of appropriate follow up of IFs. 2047 patients met inclusion criteria and 163 (8%) were included in this interim analysis. 80 (49%) patients had a PCP. 30 (24%) patients received additional follow-up of their IF. Of the patients receiving follow-up, 9 (30%) had a recommendation for follow-up highlighted in the report of their index CT scan. 48 (60%) patients had the IF included in their discharge summary. 16 (53%) were referred to a specialist, with (2) 3% of patients ultimately having a life-threatening IF. IFs are common in the ACS population. Despite efforts to inform patients of their IF, the majority of ACS patients do not receive recommended follow-up.

# Applications of Computational Homology to the Analysis of Copy Number Changes in Breast Cancer

#### Perla Aramburu Sponsor: Francisco Arsuaga, Ph.D. Molecular & Cellular Bio

How can cancer induced alterations in chromosome copy number and their corresponding gene expression change be detected? In the human body nearly two trillion cells divide every day to produce new cells. During these cell divisions mistakes occur and affect the DNA sequence structure or chromosomes. Alterations in the DNA can cause more than 10 different types of cancers we know today. Among those, breast cancer affects 200,000 people per year in the U.S. and is the second largest cause of death for women. Our work focuses on developing mathematical methods for copy number changes and gene expression profiling. We study how these two different data sets identify important alterations by applying both mathematical and statistical methods such as algebraic topology and statistical genetics. The data we analyze consists of array comparative genomic hybridization (aCGH), and gene expression profiles for a collection of breast cancer samples. Our ultimate goal is to identify cancer genes whose expression is regulated by copy number.

# The role of EYES ABSENT protein in *Drosophila melanogaster* seasonal reproductive physiology.

# Ana Armenta Vega Sponsor: Joanna Chiu, Ph.D. Entomology/Nematology

Organisms undergo physiological and behavioral changes based on seasonal-dependent environmental cues such as variations in photoperiod, i.e. daylength, or temperature. Reproductive dormancy is a seasonal adaptation observed in insects characterized by an arrest in reproductive organ development driven by shortening photoperiod as winter approaches. EYES ABSENT (EYA) protein has been shown to participate in regulating seasonal responses, including reproductive dormancy in Drosophila. EYA expression in insulinproducing cells within the pars intercerebralis, an insect brain region analogous to the mammalian hypothalamus, promotes reproductive dormancy in response to simulated winter conditions in the laboratory. How EYA expression in reproductive tissue regulates seasonal reproductive physiology has not been investigated. The Chiu lab has shown that EYA proteins are expressed in the follicle cells of Drosophila ovaries in addition to the brain suggesting that EYA expression in the ovaries could also respond to seasonal cues and play a role in local regulation of ovarian development. l use immunocytochemistry to quantify and characterize EYA expression patterns in Drosophila ovaries in response to photoperiodic and temperature changes. This will help us better understand the role of EYA in seasonal reproductive physiology, potentially adding information about the interplay between neuronal and local regulation in organismal seasonality.

# Learning to Look in a Pandemic: An Exploration on the Impact of Masks on Infant Facial Recognition

#### *Maria Arms* Sponsor: Lisa Oakes, Ph.D. Psychology

From birth, infants preferentially look to the faces in their environment. Across the first year of life, infants prioritize different regions of the face (e.g., the eyes or mouth) as various visual cues become more or less relevant. For example, as infants learn language, they may prioritize their attention to the mouth of a speaker (Lewkowicz & Hansen-Tift, 2012). As a result of the COVID-19 pandemic, face masks have become a part of daily life for many Americans, raising the question: will face masks affect our ability to recognize one another? Studies investigating this guestion have found that adults are impaired at both learning and recognizing faces with masks (Carragher & Hancock, 2020). Given the importance of faces for infants' learning, we tested whether infants would show differential learning and recognition patterns to masked and unmasked faces. Additionally, we asked parents to report on their infant's experience seeing people wear face masks. To date, we have tested approximately 50 infants aged 4- to 12-months online and are currently analyzing this data to present in the Spring. This work will contribute to our understanding of how various aspects of facial input are related to infants' learning across the first year of life.

### Demand for Type 2 Diabetes Management via Telehealth Services in Vulnerable Latino Communities

*Christina Arredondo-Lopez* Sponsor: Lorena Garcia, Ph.D. MED: Public Health Sciences

Background: With the SARS-CoV- 2 pandemic and current restrictions on in-person care, there has been increasing demand for technology-based alternatives to seeking diabetes health care management services. There is scarce research focusing on chronic disease management via telehealth services. The objective of this study was to determine the potential effects of telehealth in older, low-income Latino people in Mexican and Mexican American communities, which are disproportionately affected by diabetes. Methods: A systematic literature review was conducted. Telehealth encompasses short messaging services, video conferences, and internet surfing. Articles were pulled using these keywords on PubMed: "diabetes, older adults, telehealth, Latino." Results: Text messages are just as effective as in person programs that use the diabetes self-management education program. Amplifying medication information to patients via teleconference was likely to reach a broader audience of patients who otherwise may not have sought medical advice, both due to its easily accessible features and inexpensive method. Providing online medical resources such as diagrams, animations, and videos maximized health literacy and amplified an understanding of the disease. Conclusion: To minimize social stigma on technology and improve health literacy in Latino communities, readily available access and utilization to technical assistance and resources must be established.

# Mechanical and Thermal Analysis of CubeSat Structure for Simulated Launch and Orbital Environments

Jacqueline Arroyo Donjuan Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The Space and Satellite Systems (SSS) club's REALOP mission is to create a 2U CubeSat expected to launch in 2021. The Structures team of SSS has two analysis sub-teams: mechanical and thermal analysis. The goal of both teams is to simulate launch conditions followed by a transient orbit around the Earth to verify CubeSat nominal operations. To create these simulations, the mechanical analysis team uses Solidworks with launch data provided by Nanoracks and Antares while the thermal analysis team uses Thermal Desktop. The thermal analysis sub-team is in the process of preparing a basic model of the CubeSat to showcase the effects of radiation on the external faces of the frame, as well as internal heat transfer between the inner components/faces of the frame. This analysis determines if insulation or a material finish is needed, and verifies that the CubeSat survives in orbit. The mechanical analysis team performed 11 quasi-static tests; including rotational, translational, and vibrational loads using restrictions such as remote loads to obtain Finite Element Model (FEM) mesh stresses and displacements that fall within expectations. The two teams replicate the conditions that CubeSat will undergo through the use of different software to simulate sensible mission results.

# Mechanical and Thermal Analysis of CubeSat Structure for Simulated Launch and Orbital Environments

Justin Asahan Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

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#### The Role of Digital Media on College Students' Future Career Beliefs

#### *Liana Mae Atizado* Sponsor: Adrienne Nishina, Ph.D. Human Ecology

As students were forced to spend months at home during the COVID-19 lockdowns, digital media has played an increasingly prominent role in their lives. With racial tensions rising, many may be exposed to racial discrimination online. These negative experiences may shape college students' expectations of future social environments. Drawing on data from a longitudinal study following college students, this study examines the relationship between exposure to negative representations of one's ethnicity/race in digital media and their perceptions of their future career environment. Participants were 227 college students (33% White, 30% Asian, 12% Latinx, 10% Multiethnic, 9% Other). Analysis of bivarriate correlations found that being exposed to untrue statements about your ethnic/racial group on digital media is positively associated with expecting to be treated differently in your career because of your ethnicity/race (r = .16, p = .02), expecting to experience difficulty getting hired because of your ethnicity/race (r = .25, p < .001), and expecting to experience ethnic/racial discrimination in your career (r = .16, p = .02). These findings highlight how exposure to racist digital media can lead to expectations of discrimination in one's future workplace environment. Future analyses will consider multiple time points and disaggregate findings across ethnic-racial groups.

### Parenting Effects on Language Development in Mexican-American and Chinese-American Dual Language Learners

Man Ling Au Sponsor: Yuuko Tonkovich, Ph.D. Education

Past research has found mixed results on the relation between parenting styles and the development of young children's language skills. More research is needed with dual language learners (DLLs) to promote bilingual development, especially to maintain their heritage language skills. This project was anchored to examine parenting styles and practices in families with DLLs and to investigate the association between parenting styles (authoritarian and authoritative) and parenting practices (amount of parent-child activities) and their collective effects on Mexican American (MA) children and Chinese American (CA) DLLs' oral comprehension and vocabulary retention of heritage language, controlling for confounders of parental language dominance and parental educational levels. Data were collected from a total of 55 MA and 64 CA DLLs enrolled in Head Start programs and their first-generation parents. Parenting Styles and Dimensions Questionnaire (PSDQ) and demographic survey were completed by parents to investigate parenting styles and parenting practices. MA and CA DLLs were assessed on their heritage language oral proficiency. Preliminary results suggest that parenting styles and practices were similar for MA and CA parents and parenting practices were more associated with children's heritage language development than parenting styles. Implications for families will be discussed.

Jason Avalos Sponsor: Tiffany Lowe-Power, Ph.D. Plant Pathology

Ralstonia solanacearum is a major bacterial phytopathogen that causes bacterial wilt and attacks a plethora of crops with the pathogen having a wide geographical range. This study's aim is to develop a database of the extensive diversity of R. solanacearum strains. To do this we are currently examining literature consisting primarily of studies perform 16S sequencing in order to determine a particular strain's phylogenetic identify. We then synthesize the information from the studies in order to ascertain a strain's associated phylotype/sequevar and their genetic accession numbers. We also record a strain's pertinent information such as its geographic location, year of isolation and its isolation host. Through this database we investigate the relationships between these strains and develop phylogenetic trees that could better illustrate these relationships and their origins. I have catalogued the isolation locations, isolation hosts and phylotype-sequevars of 968 distinct strains. The strains were isolated from 192 locations, 61 distinct hosts, and were identified as members of 38 distinct sequevars. Work on this study continues as we examine more literature and synthesize information that will help to detail and categorize the many strains of R. solanacearum and the relationships between the distinct strains.

# Spatial Organization of the CoQ Biosynthetic Pathway

*Amrutha Ayyer* Sponsor: Jodi Nunnari, Ph.D. Molecular & Cellular Bio

Coenzyme Q (CoQ) is a redox lipid synthesized within mitochondria and is essential for the electron transport chain and oxidative phosphorylation- a primary source of ATP in eukaryotic cells. Consequently, CoQ deficiency is linked to numerous human diseases ---including encephalopathy, liver failure, and myopathy. Recently, our lab discovered that components of the CoQ biosynthetic pathway selectively assemble in a manner dependent on CoQ production into mitochondrial inner membrane-associated domains, enriched at ER-mitochondrial contact sites. We hypothesize that CoQ domains are required for the efficient processive production and distribution of CoQ in cells. To further our understanding about CoQ assembly and their structural organization, we are determining the stoichiometry of endogenously expressed functional GFP-tagged Coq proteins within domains. The CoQ protein copy number will be determined by comparing GFP fluorescence intensity to a standard of a known copy number, which is the centromeric protein Cse4-GFP. This data will allow us to determine the relative stoichiometries of Cog proteins and thus will provide us insight into the structure of CoQ domains and their assembly.

#### Associations of Nutritional Data and Glycemic Variability in Patients with Chronic Kidney Disease

#### Harshanna Badhesha Sponsor: Baback Roshanravan, M.D. MED: Int Med Nephrology (sac)

Sarcopenia, defined as a decrease in muscle mass or function, is highly prevalent in patients with Chronic Kidney Disease (CKD). Insulin resistance, considered the primary mechanism leading to sarcopenia in patients with CKD, can manifest as impaired glucose homeostasis. The purpose of this study is to measure glycemic variability in patients with moderate to severe CKD and its association to nutritional data collected from dietary recalls. Patients, part of the ESTEEM-CKD study, wore a continuous glucose monitor (CGM) for an average of 14 days. Time in target was determined to be between 70 mg/dL to 140 ma/dL. Within the CGM period, 3 dietary recalls were performed using the ASA24 software. Dietary variables collected include total kilocalories, carbohydrates, fiber, protein, and fat. Variables collected from the CGM include mean glucose, mean time in target, and mean time below and above target. Dietary data was examined in comparison to the mean time in target values. Additionally, diet quality was assessed with the use of the Healthy Eating Index 2015 (HEI-2015). This will further our understanding of the association between dietary recalls and data obtained from 2-week continuous glucose monitor.

# Examining Speech Toward Alexa versus humans: A comparison of adults and children

#### Alessandra Bailey Sponsor: Georgia Zellou, Ph.D. Linguistics

Voice assistants such as Alexa and Siri are now commonly used in the home and everyday life, yet our scientific understanding of these interactions is still in its infancy. This study tests how people of different ages (college-age adults and children, ages 7-12) talk to an Alexa device versus a human. The interactions, conducted over Zoom due to social distancing restrictions, were controlled so that participants said the same sentences to the Alexa and human interlocutors. Subjects see a list of 24 words and, on each trial, the experimenter or device asks what the next word on the list is. The subject replies with the corresponding word on their list ("The word is pig"). Then, the experimenter or device says the word back and asks the subject to repeat the sentence; on 4/24 of trials, the interlocutor mishears the pronunciation, saying a second word with a consonant error ("I heard pig or pick"). Videos are annotated in ELAN and manually checked. We predict that adults and children will show differences in the way they adjust their speech for a human versus Alexa interlocutor. Broadly, this work can reveal the impact of voice assistants on language behavior across the lifespan.

*Kavenpreet Bal* Sponsor: Marina Crowder, Ph.D. Molecular & Cellular Bio

The Punjabi-Sikh population, originating from Northern India, faces vast amounts of health disparities that are exacerbated by genetic predispositions, immigration difficulties, cultural assimilation, language barriers, and a preference for traditional South Asian cuisine. This community is severely understudied, despite suffering from disproportionate amounts of chronic conditions, including but not limited to diabetes mellitus, obesity, cancer, hyperlipidemia, and coronary artery disease. In the status quo, very low amounts of published studies, information, or data sets exist pertaining to the Puniabi-Sikh community, which has undoubtedly contributed to the steady decline in health equity. Health implications and variables for this patient population in the United States, and California in particular, have not been explored as intensively, despite harboring a large relative percentage of the Punjabi-Sikh community. Building upon the limited yet vital pre-existing literature, it is essential to evaluate correlations among healthrelated variables for the Punjabi-Sikh community in the Greater Sacramento area to furnish patient care and improve methods of health intervention. Utilizing regression analyses, this research takes an incumbent step to increase the representation of this community within medicine while enabling the scientific community to develop more effective health intervention techniques.

# Amino Acid Proportions of Na+/H+ Antiporter in Halophiles vs Non-Halophiles

*Kavenpreet Bal* Sponsor: Robert Furrow, Ph.D. Wildlife & Fisheries Biology

Halophiles can have multiple Na+/H+ antiporters due to their exposure to extreme levels of salinity and the course of evolution. Studies have articulated why Na+/H+ antiporters are essential to halophiles: living in a high salinity environment and creating new adaptations while trying to reproduce requires vast amounts of energy. Halophiles increased the number of Na+/H+ antiporters they had to increase the amount of Na+/H+ they could bring across their membrane. The Na+/H+ antiporter serves to maintain homeostasis while utilizing chemiosmosis, enabling the activation of the Proton Motive Force and ATP Synthase to fuel ATP production. Large concentrations of salt impact the hydrophobic interactions and covalent bonding of proteins, affecting their structure and folding. However, hydrophobic amino acids can shield protein charges and decrease salinity impact on protein structure. Analyzing the amino acid proportions among halophiles versus non-halophiles provides information to discern whether significant differences exist in the prevalence of hydrophobic amino acids. Additionally, it will help determine the relationship between hydrophobic amino acids, such as isoleucine, and high salinity environments. Analyzing salinity impact on halophilic proteins can be used to better understand halophiles and ultimately treat hypersaline waste.

#### State-level Variation in Sex Education Policies and Implications for Sexually Transmitted Infections

#### *Eve Banas* Sponsor: Damien Caillaud, D.V.M.,Ph.D. Anthropology

In the United States, nearly half of sexually transmitted infection (STI) cases occur in adolescents and young adults. American sex education curricula vary widely across each state, raising concerns about education quality. Today, 40 states require that abstinence advice be included during sex education, despite the demonstrated lack of efficacy of this approach. Some states never mandate sex education in school. This study examines the correlation between sex education policies on STI diagnoses in the U.S. over nearly two decades (2001-2018). Using data on Chlamydia trachomatis infection, Neisseria aonorrhoeae infection, and HIV diagnoses from the Centers for Disease Control and Prevention, we analyzed the infection rate in people aged 13-24. Our data reveal considerable variation in STI prevalence among states and rising infection rates across the country. We predict lower STI prevalence in states with mandated sex and STI education and that the addition of policies promotes this decline. It is important to evaluate whether our current sex education policies produce tangible changes in transmission. If certain policies have little impact on STI prevalence, new strategies need to be developed. Our findings can help inform public health and education policies to ensure effective sex education is available across the country.

# Parental Scaffolding Prepares Groundwork for Children to Thrive with Executive Functions

Antoinette Banks Sponsor: Yuko Munakata, Ph.D. Psychology

Executive function skills (EFs) are essential for a child to prioritize daily tasks, control impulses, filter distractions, and accomplish milestones. EFs continuously develop over the lifespan. Importantly, research has demonstrated that parental scaffolding behaviors have long-term links with the development of children's cognitive abilities. As parents tailor their teaching and support styles to their child's needs, they essentially act as the "executive" in completing the task until the child's EFs are strong enough to complete the task independently. The effectiveness of scaffolding hinges on the contingency rule: when the child struggles, the parent raises the level of support given. When the child succeeds, the parent slowly reduces the amount of support given. A meta-analysis will therefore be conducted to determine the strength of the relation between various parental scaffolding techniques and executive functions. This analysis seeks to explore the correlation between parental scaffolding behaviors and children's executive function development.

# A Quantitative Analysis of Oligosaccharides with Liquid Chromatography/Mass Spectrometry

Audrey Bantug Sponsor: Carlito Lebrilla, Ph.D. Chemistry

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

# Technical Development and Assembly of a Modular Cubesat

*Xiao-Bao Bao* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The REALOP CubeSat of the University of California, Davis team utilizes a new design that is modular and provides more access to internal payload components. To achieve ease of accessibility and modularity, the structures team designed mounting brackets and a unique printed circuit board (PCB) housing unit that are easy to modify and reorganize without having to take apart the whole satellite assembly. The assembly preparation team is currently working towards a standardized integration plan that carefully documents the process of assembling each payload component. A database of wellorganized and detailed documents was made to tackle the multiple challenges in developing an assembly procedure that independently integrated each of the critical payload components, PCBs, and wire routes with the structural frame. The assembly will consist of installing deployment switches, payload components and their respective mounting brackets, Xfaces, Y-faces, Z-faces, and finally solar panels. These new designs and standardized integration documents will be used for future CubeSat missions and testing.

#### Site Specific N-glycoproteomic Analysis of Human Serum for Alzheimer Disease Biomarker Discovery

#### Maria Fernanda Barajas Mendoza Sponsor: Carlito Lebrilla, Ph.D. Chemistry

Glycosylation is a complex post-translation modification important for mediating cellular processes critical to the development and function of organisms. Glycosylation defects could alter human physiological conditions resulting in disease development and progression. An altered glycosylation has been identified in the hallmark proteins associated with Alzheimer's disease (AD). The major neuropathological hallmarks of AD include neurofibrillary tangles formed by the abnormal accumulation of Tau protein and amyloid plagues formed by the extracellular aggregation amyloid ß-peptide (Aß). These plaques and tangles disrupt cell function and communication between neurons culminating in progressive damage to the brain, particularly to the brain region involved in memory. Current AD diagnosis relies on evaluating symptoms and documenting cognitive decline, but by then changes in the brain have caused irreversible brain damage. Identifying biomarkers that detect AD in its early stages offers the potential of early intervention. By using mass spectrometry specifically, the multiple reaction monitoring (MRM) method we can quantitively monitor 200 glyco-sites across 50 brain serum glycoproteins. While the quantitative data analysis is ongoing, this study has the potential to identify down or up regulated glycoproteins in AD for biomarker discovery.

#### Enemies of Order, Enemies of Progress: Indemnification and the Abolition of Brazilian Slavery, 1883-1888

Jake Barrett Sponsor: Jose Perez Melendez, Ph.D. History

From 1879 to 1888, abolitionists in Brazil waged a national campaign against the institution of slavery. Elite reformers and radical journalists formed coalitions with working-class activists and enslaved Afro-Brazilians ultimately securing the legal abolition of slavery on May 13, 1888. The central platform espoused by the national abolitionist movement from 1883 to 1888 was "immediate abolition without indemnification," a platform hostile to both gradual abolition and the right of slaveholders to demand indemnification from the state for emancipated slaves. This paper utilizes newspapers, publications from abolitionist and proslavery organizations, and parliamentary debates to examine how indemnification was used by abolitionists and proslavery coalitions alike to characterize their opposition as enemies of the Brazilian nationstate. For advocates of immediate and uncompensated abolition, those demanding indemnification were morally degraded enemies of progress. For advocates of compensated, gradual abolition, those who condemned indemnification were enemies of order and property rights. This paper focuses on the central discursive and legislative importance of indemnification during the abolitionist campaign from 1883 to 1888, whereas past scholarship has largely considered indemnification in passing (as a facet of the broader abolitionist campaign), or in the context of the post-abolition destruction of slaveholders' financial records in 1890.

Raymond Barsch Sponsor: Diane Beckles, Ph.D. Plant Sciences

Tomatoes are universally popular, high in fiber and antioxidants, and are revered for the 'authenticity' they add to many cultural dishes. However, consumers have expressed unhappiness with the quality of store-bought tomatoes, because trades-offs made with respect to enhancing shelf-life and optimizing quality. To prolong shelf-life, tomatoes may be harvested before they reach full ripe and stored for variable periods before consumption, conditions that destroy fruit quality compared to fruit harvested when ripe. The genes that are affected by different postharvest storage conditions have not been fully characterized, but a better understanding of their mode of action may help to improve tomato quality. Transcriptomics and methylomics were used to identify genes whose expression changed in concert with changes in tomato fruit quality due to different postharvest handling. Several differentially expressed genes were identified, many of which have not been previously implicated in tomato fruit quality. In this work, we initiated a bioinformatic analysis of these genes and their cognate gene families, in tomato and other species, to determine if they are universally involved in fruit quality or ripening. This is the first step towards their functional analysis in fruit, using reverse genetics approaches, and long-term improvement in commercial fruit quality.

# Establishing the RXR Ligand Regulated Gene Network in the Developing *Xenopus laevis* Brain

Vincent Basas Sponsor: John Furlow, Ph.D. Neuro Physio & Behavior

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

#### California Fever: Madness in Gold Rush Era California

Danielle Baza Sponsor: Gregory Downs, Ph.D. History

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

#### Infant Motor Development Influencing Visual Preference

**Rebecca Beaton** Sponsor: Lisa Oakes, Ph.D. Psychology

Infants are incredibly adept learners, possessing the ability to gather pertinent environmental information about the world and how it works. This study investigates the relationship between an infant's access to information, in the form of motor development, and their visual attention to objects with complex features. Research has shown a robust link between infant experience manipulating objects and their visual attention to object properties. In the present study, 4-12-month-old infants (N = 100) were shown pairs of unfamiliar objects. One object was easily "graspable", with a handle-like region, specialized for grasping, while the other was not. Additionally, parents completed a motor development questionnaire about their infant's motor abilities. All data were collected through the Lookit online platform and coded with Datavyu software for the duration of looking at both objects. We hypothesize that increasingly complex motor capabilities, such as crawling or walking will influence the features of objects that infants find most interesting. Thus, an infant with motor ability that allows for object obtainment and manipulation will show a visual preference for objects with specialized features, such as handles.

#### Assessing the Development of Visual Short-Term Memory in the Preschool Period Using an Online Change-Detection Task

### Caroline Beel Sponsor: Lisa Oakes, Ph.D.

Psychology

Visual short-term memory (VSTM) is the ability to briefly store and maintain visual representations during disruptions in information that occur during eye movements and blinks. The current study examines VSTM during the preschool period using a change detection task on an online testing platform (Gorilla.sc). In change detection, participants are presented with a sample array containing several different colored squares, followed by a delayed period (during which they have to remember the sample items), and finally a test array containing the previously presented items and one or more changed items. Infants demonstrate their VSTM for the items in the sample array by looking longer at the changed items to the non-changed items in the test arrays (Oakes et al., 2013). We adapted this task and tested fifty 12- to 48-month-old children. Ongoing analyses will provide insight into (1) how VSTM develops from infancy through early childhood and (2) whether we can detect VSTM in children using an online platform.

#### Developing a Model for Community-Driven Single-Use Plastic Reduction in Local Restaurants

#### Alessandra Beelen

Sponsor: Andrea Schreier, Ph.D. Animal Science

The presence of plastic waste in the oceans poses a major threat to marine ecosystems. Numerous marine organisms become entangled in or unintentionally ingest plastic debris, and yet, much of the population is unaware of the consequences of single-use plastics. This project aims to investigate single-use plastic consumption in local restaurants in Davis in order to develop a collaborative model that can be adapted to support and encourage restaurants to transition away from single-use plastics in Davis and other cities. This collaborative model would allow project stakeholders to use social capital to incentivize the reduction of single-use plastic in restaurants through community promotion. We will conduct research regarding conventional material costs, costs of alternatives, how current businesses incorporate compostable products, and consumer preference for sustainable materials. By investigating the cost and process of transitioning from conventional to compostable materials, we can determine the feasibility of convincing local businesses to employ this model throughout the city.

Nishchala Beeram Sponsor: Naomi Janowitz, Ph.D. Religious Studies

When the British sailors arrived in Hawaii, they were very concerned with and fascinated by the native Hawaiians' practices relating to sexuality and anthropophagy. The British created many accounts alleging the Hawaiian women were very eager to have sex with the sailors as well as that the Hawaiians took delight in consuming human flesh. However, these accounts are culturally skewed. They do not answer the question: what, if any, was the role of sexuality and anthropophagy in Hawaiian religion? I will argue that many of the Hawaiians' practices relating to anthropophagy and sexuality were religious rituals with the purpose of connecting with the divine, rather than mere hedonistic indulgences as the British thought. I will also examine the British sailors' own practices relating to anthropophagy and sexuality in their religion. I will then compare the differences in the role of sexuality and anthropophagy in Hawaiian religion and British Protestant beliefs.

#### Experimental reproduction of bone tools - an attempt to quantify relative complexity of bone projectile points from Middle/Late Stone Age Africa

**Sean Begg** Sponsor: Teresa Steele, Ph.D. Anthropology

During the transition between the Middle and Late Stone Ages (30,000-60,000 years ago) in Africa, archaeologists have long recognized a sudden explosion in technological diversity. The behaviors these technologies represent have conventionally been regarded as increasingly more complex. The addition of bone technology is considered one of these complex technologies, but how complex is it really? Here I investigate the level of investment needed for different methods of bone point production to understand when a forager might choose one over another. I describe the current state of research regarding this technology. I present results of early experimental attempts to produce bone points. I am producing both formal and informal bone projectile points to better understand the level of complexity of this technology. I have simulated the process by which ancient people processed bones for marrow. Next, I will attempt to create projectile points from any suitable blanks in the resulting detritus. After creating different points using a more formal method, the efficiency of the two methods will be compared in terms of the length of time processing takes and the number of blanks produced with each method to gain insight into the technological decision making of ancient humans.

*Miranda Bell* Sponsor: Jeremy Mason, Ph.D. Materials Science&engineering

Fluid flow through a porous medium is a complex phenomenon that is relevant to multiple engineering areas, but for which few analytical solutions are available. The field of computational fluid dynamics is concerned with finding the numerical solutions for these fluid flows. One well-established method to model complex fluid flow is the Lattice-Boltzmann Method (LBM). An efficient algorithm for modeling single-phase and multiphase fluid flow with complicated boundary conditions. The results of the LBM simulations will be presented for mass density flow through two- and three-dimensional porous samples for incompressible fluids with variable viscosities, densities, and velocities using the Bhatnager-Gross-Krook (BGK) approximation. More specifically, the LBM will be tested for channel flow of incompressible fluids and particle accumulation. Assuming symmetrical boundary conditions for the upper and lower boundary walls, different porosities will be considered for the channel. As such, the simulations will reproduce the results contained within the literature to identify the impact of the structure on fluid movement.

# Septins Regulate the Diffusion of Cortical Atg9 Vesicles During Autophagy

*Sriharish Bellamkonda* Sponsor: Kenneth Kaplan, Ph.D. Molecular & Cellular Bio

The process of autophagy targets organelles and proteins for degradation in the vacuole/lysosome and is a critical pathway that ensures cell survival after cell stress, or perturbations in homeostasis such as nutrient deprivation or protein misfolding.? Induction of autophagy pathways must be balanced with their down-regulation to ensure cells return to homeostasis and maintain viability, however it is not well understood how this pathway is constrained. Upon nutrient deprivation, autophagy membranes form around cargo at an assembly site where Atg9-vesicles are trafficked from exits sites in the cortical endoplasmic reticulum (ER). Recent work in the Kaplan lab implicates septin filaments that form near cortical ER exit sites in limiting the formation of autophagy membranes. We hypothesize that septins do this by constraining the free diffusion of Atg9vesicles at the cortical ER. We will use Atg9-3XGFP to collect high time resolution images in living wild type and septin mutant cells. Displacement of Atg9 vesicles will be measured using a frame-by-frame comparison algorithm. However, the algorithm relies on the accuracy of ImageJ to pinpoint foci. Therefore high noise in frames caused error in the algorithm's ability to recognize Atg9-vesicles. By developing a machine learning process, Atg9-foci can be recognized with higher accuracy.

#### Exploring the Bioclimatic Distribution of a Worldwide Plant Pathogen

### Jozanne Elizabeth Berdan Sponsor: Daniel Kliebenstein, Ph.D. Plant Sciences

Botrytis cinerea is a pathogenic fungus that forms a gravish mold that infects a wide range of plants. It creates a devastating financial loss for vegetable, fruit, and ornamental plant growers. Botrytis thrives in cool and wet spring and summer weather, usually around 15-25°C. Although Botrytis is a widespread plant pathogen, its genetic diversity and bioclimatic distributions are not well documented at a large scale. To address those distributions, the lab created a database of more than 9000 strains. The database is a combination of a meta-analysis of strains of 48 studies describing strains of Botrytis from different regions of the world, and the global weather and climate data from the WorldClim dataset. The variables include the host species and extreme or limiting environmental factors, specifically the temperature of the coldest and warmest month, and precipitation of the wet and dry guarters. Such metaanalysis dataset provides an avenue to explore questions on the susceptible hosts, the critical times and climatic conditions for Botrytis infection using data analysis and statistical tools such as R.

#### CDK1 Enhances Mitochondrial Bioenergetics for Radiation-Induced DNA Repair

*Jonathan Berg* Sponsor: Jian-jian Li, M.D.,Ph.D. MED: Radiation-oncology

It is well-known that radiation induces cell death due to nuclear DNA damage. To survive, cells need to maintain their genomic stability via rapid DNA repair processes; lack of or insufficient repair mechanisms leads to apoptosis or abnormal cell proliferation and cancer risk. DNA repair is a well-defined energy consuming process, however the fueling mechanism and contribution of mitochondrial energy production remains unclear. Here, we report that radiation enhances mitochondrial ATP generation and mitochondrial relocation of cell cycle kinase CDK1, which is linked with the nuclear DNA repair capacity. Enhanced mitochondrial ATP generation is reversed in cells harboring CDK1 phosphorylation deficient mutant complex I subunits. Mitochondrial ATP generation and nuclear DNA repair are also severely compromised in cells harboring mitochondrialtargeted kinase deficient CDK1. These results demonstrate a unique mechanism governing the communication between mitochondria and nucleus, in which mitochondria-relocated CDK1 boosts bioenergetics to meet the increased cellular fuel demand for DNA repair and cell survival under genotoxic stress.

# Measuring the Mitochondrial Metabolism and DNA Damages in Mammalian Cells

Jonathan Berg Sponsor: Jian-jian Li, M.D.,Ph.D. MED: Radiation-oncology

Nuclear DNA repair capacity is a critical determinant of cell fate under genotoxic stress conditions including ionizing radiation and anti-cancer chemotherapy. DNA repair is a well-defined energy consuming process; however, it is unclear how DNA repair is fueled and whether mitochondrial energy production contributes to nuclear DNA repair. We have shown that radiation enhances mitochondrial ATP generation and mitochondrial relocation of cell cycle kinase CDK1, which is linked with the nuclear DNA repair capacity. The enhanced mitochondrial ATP generation is reversed in cells harboring CDK1 phosphorylation deficient mutant complex I subunits. Mitochondrial ATP generation and nuclear DNA repair are also severely compromised in cells harboring mitochondrial-targeted kinase deficient CDK1. In addition, we recently found that cells with circadian gene deficiency are more sensitive to radiation than cells with the circadian gene functional. We are currently studying the DNA repair capacity by measuring DNA repair enzyme activity and DNA damage foci formation following radiation. Together, our results indicate that mitochondrial energy metabolism and nuclear DNA repair are in active communication to enhance cellular homeostasis that is required to defend against genotoxic stress conditions. Further elucidation of the mitochondrial-nuclear pathway will help to define therapeutic targets in cancer radiotherapy.

# Examining the Effects of Handedness on Finger Control and Stability

*Guneet Bindra* Sponsor: Wilsaan Joiner, Ph.D. MED: Neurology

Handedness (e.g., right or left-hand dominance) has been shown to influence motor performance and limb coordination. In this preliminary study we created a setup and implemented a common motor learning manipulation (a gain perturbation) to examine how handedness affects finger movement adjustments. In the setup, a finger-tracking device (Leap Motion, Inc.) monitored index finger position, which was translated to screen cursor movement. The task requires subjects to produce a grip (e.g., a fist) in order to move the cursor to a target. After an initial baseline phase, we increase the gain of the cursor movement by 20%; the cursor travels 20% further for the same finger movement during baseline. We expect that subjects will learn to modify their grip pattern to compensate for the visual feedback disturbance. Throughout testing, subjects will complete trials with four target/finger movement levels (e.g., 25%, 50%, 75% and 100% movement). After testing the dominant hand, subjects will perform the same task on their non-dominant hand. We expect that right-handed subjects will demonstrate a faster learning rate with their dominant hand in response to the perturbation. The long-term goal is to use this task to assess handedness and dominance-based differences in dexterous finger control.

#### Understanding Institutional Culture as a Limit to Addressing Sexual Harassment: A Case Study of One Bay Area High School

# Sarah Bjerkholt

Sponsor: Robert Faris, Ph.D. Sociology

The purpose of this thesis is to investigate institutional and cultural barriers to preventing and addressing sexual harassment in high schools. This research relies on a case study of one California high school. Research will be collected through qualitative interviews with former students, staff, and school administrators. In addition, data will also be gleaned from the examination of public data such as school board meeting records and school policies dating from 2013 to present. Preliminary research suggests that there are a multitude of structural and cultural impediments to effectively addressing rape culture and sexual harrasment among peers and from staff to students within high schools. I explore whether sex positive sexual health messaging can be misconstrued, creating additional pressure on targets of harassment. This research aims to highlight issues preventing the cultural shift needed to address school based sexual harassment and spotlight areas for policy and institutional changes.

# Investigating the Regulation of Chromosomal Crossing Over in *Brca2* Deficient Spermatocytes

Devon Blount Sponsor: Neil Hunter, Ph.D. Microbiology & Molec Genetics

Meiosis is a fundamental process in sexually reproducing organisms that leads to the formation of haploid gametes (eggs and sperms) from diploid germ cells. The reduction in chromosome number is mediated by homologous recombination, which leads to chromosome pairing and crossing over. Crossover formation is tightly controlled event as errors in this process can lead to chromosome missegregation resulting in infertility, pregnancy miscarriage, and congenital disorders. Breast Cancer Associated factor, BRCA2 plays an essential role in regulating homologous recombination by recruiting the DNA pairing and strand-exchange protein RAD51 to sites of DNA breaks. However, the role of BRCA2 in regulating homologous recombination during meiosis is not well understood. To investigate the role of BRCA2 during meiosis, our lab used a conditional mutant allele of the essential Brca2 gene that is inactivated using a meiosis specific Cre recombinase. Our preliminary analysis of spermatocyte chromosome spreads from age-matched mutant and control mice suggests that, besides its expected function in early steps of meiotic recombination, BRCA2 also promotes a normal distribution of crossovers; specifically at least one crossover per chromosome (called crossover assurance) and adjacent crossovers that are widely spaced (crossover interference). I am investigating how BRCA2 might contribute to these crossover control processes.

#### A Review of PFAS Effects on Animal Models: Reproductive and Developmental Health Impacts

Janae Bonnell Sponsor: Michele La Merrill, Ph.D. Environmental Toxicology

Per- and polyfluoroalkyl (PFAS) chemicals are used in the production of many consumer goods and various industrial processes, and they have been widely detected in samples from both humans and animals. PFOS and PFOA have been comprehensively studied and are being phased out of use, but there are many other understudied PFAS chemicals with potential adverse effects that should be considered in regulatory affairs regarding public health and safety. In this study, we focus on how the reproductive health and development of animal models is affected by exposure to seven chemicals: perfluorononanoic PFAS acid (PFNA). perfluorohexanoic acid (PFHxA), perfluorohexane sulfonic acid (PFHxS), 4,8-dioxia-3H-perfluorononanoic acid (ADONA), perfluorobutane sulfonic acid (PFBS), perfluoroheptanoic acid (PFHpA), and perfluorodecanoic acid (PFDA). This literature review presents the observed reproductive and developmental effects of these chemicals on animal models, which can be used to help establish legislative priorities and draw attention to current gaps in published research.

# Neural Selectivity in the Temporal Domain of the Auditory Cortex in Aged Rhesus Macaques

**Parish Bracha** Sponsor: Gregg Recanzone, Ph.D. Neuro Physio & Behavior

Presbycusis is a type of age-related hearing deficit that begins around middle age and affects more than 50% of individuals 70 and older. It is characterized by a gradual decline in hearing capabilities as age increases and is particularly present in acoustically challenging environments or when involving complex signals. My project is focused on the hypothesis that this deficit is caused by neural activity in the rostral regions of auditory cortex being differentially affected by aging and hearing loss compared to caudal auditory cortical regions. To test this hypothesis, I analyzed neuronal data from regions R (rostral) and A1 (caudal) of the auditory cortex. My preliminary findings show higher neural selectivity in area R, lower firing rate in nonreorganized regions of R than A1, as well as no significant difference between spatially and temporally modulated sounds. My next step is to analyze areas R and A1 for spatial sensitivity, as well as analyze other areas of the auditory cortex in which data has been previously collected. Significant findings in these experiments would illuminate the largely uninvestigated areas of core regions processing in the auditory cortex and allow for advancements in speech processing and comprehension in those with presbycusis.

#### A Statistical Physics Description of Glacier Calving Behavior in Ice-Shelf Evolution

Paige Brady Sponsor: John Rundle, Ph.D. Physics

Ice-shelves are free-floating platforms of ice that provide buttressing forces to land-based glaciers. The collapse of an ice-shelf due to calving may cause additional ice to enter the ocean and contribute to global sea-level rise, motivating a need for estimates of the likelihood of this type of event. However, significant challenges persist in incorporating the dynamics of calving glaciers into large-scale ice-sheet simulations. In this study, we introduce passive tracers with fiber bundles of random strengths to a one-dimensional shallow-shelf in order to simulate the strains and stresses which lead to discrete fracturing and calving. These tracers advect along with the iceshelf until the fiber bundles reach a critical elongation based on randomly distributed strengths. The bundle then breaks, initiating a calving event in the shelf. We will discuss preliminary results from this model that reproduce the style of calving at the Erebus ice-tongue in Antarctica, including quantifying the average number of calving events for Erebus over a 100 year time-scale. We propose that this model will be successful in estimating average long-term ice-shelf calving events, as well as determining whether there is a condition under which normal calving behavior becomes a catastrophic collapse.

#### Into My Mother's Womb

#### Grace-Lynn Bridges Sponsor: Cristiana Giordano, Ph.D. Anthropology

Slavery was the first attack on the Black family unit, making it nearly impossible for family formation, let alone stability and security within these bonds. During slavery, Black mothers were renowned for trying to protect their children, and keep the family together. Nearly 200 years later violence against the Black community persists. Many of these evils acts have been justified in systematic ways: The Black Codes, Jim Crow, mass incarceration and police violence. Karl Marx argued that capitalism seeps down even into the family unit, and so lask: does not structural violence do the same? Through ethnographic interviews with Black mothers and archival research, my hope is to bear witness to the voices that have been drowned out and turned into statistics. I am interested in exploring how violence enters the home shaping subjectivities and relationships, psychic experiences and bodily presences. For centuries, Black families have had to navigate an extremely violent America. This research project posits to understand just how parents teach or do not teach their children to circumvent societal strain and trauma. As a society we've separated the private from the public, I aim to express just how interconnected the domestic and the social really are.

Madison Brigham Sponsor: Joel Porquet, Ph.D. Engr Computer Science

In terms of students enrolled, UCD computer science (CS) classes are typically male dominated, which can create a baseline perception of male dominance in class participation. We analyzed participation scores received by male and female students in two core computer science classes across ten quarters to explore the question: Is there a difference in male and female participation scores, and does this disproportionately impact male and female students' final grades? We find a small gender gap in overall participation scores, but no significant difference between the rate at which male and female students' grades benefit from participation points. However, we do see a difference in behavior in different formats of participation: males score higher on average in more public formats, such as lecture and forum, while females score higher in more anonymous formats, such as survey completion. Therefore, instructors should diversify their definitions of participation to accommodate for gender correlated preferences in participation formats. Furthermore, we find that the top scorers in the most public forms of participation are disproportionately male. This explains the perception of a larger gender gap in participation than actually exists, which can enforce the stereotype that males have a greater aptitude for CS than females.

#### Synthesis and Duplex Stability of N2-Alkyl 8-Oxo-2'deoxyguanosine Oligonucleotides for use as Substrate Analogs for DNA Repair Protein MutY

*Madeline Bright* Sponsor: Sheila David, Ph.D. Chemistry

Reactive oxygen species cause oxidative damage to nucleobases in DNA which results in 8-Oxoguanine (8-OG), a common oxidative product which mispairs with adenine. Such 8-OG:A mispairs cause G:C to T:A transversions upon DNA replication, a build-up of which is destructive to the cell. MutY, a base excision repair (BER) enzyme, combats oxidative damage to guanine nucleobases in DNA by cleaving the mispaired adenine. This cleavage results in an abasic site across from 8-OG, which is repaired by downstream BER enzymes. Inherited variants of MUTYH, the human homolog, have been linked to the initiation and development of carcinogenesis. How MutY is able to differentiate the mispaired adenine from correct T:A pairs is the focus of my research in Sheila David's lab. This work will determine the effect of steric bulk and hydrogen bonding imparted by the 2-amino of 8-OG on the target recognition mechanism of MutY via 8-Oxo-2'-dG analogs modified at the 2position. It will also analyze the duplex stability of produced oligonucleotides. Synthetic analogs will help reveal the structural features dominant in MutY's target recognition of the 8-OG:A mispair when subjected to binding, kinetics, and cellular repair assays.

#### Christina Brown Sponsor: Mimmie Kwong, M.D. MED: Surgery

Current guidelines recommend utilization of ankle brachial index (ABI) for surveillance after infrainguinal revascularization. Little guidance exists regarding the ideal timing of this. To study this, we performed a retrospective review of infrainguinal procedures between July 2014 and November 2019 at an academic center. Patient information, procedural details, and pre- and post-operative ABI and toe-arm indices (TAI) were collected. 711 patients underwent infrainguinal revascularization for peripheral arterial disease. 404 patients had a valid postprocedural ABI or TAI. Locally-weighted regression of the TAI demonstrated early improvement with a steep rise in TAI within the first two days, followed by continued improvement until a plateau at 20 days. 36 patients underwent two studies within 30 days of their procedure. Of these, five (13.9%) had a significant (>0.15) decrease in their TAI, 19 (52.8%) had no change, and 12 (33.3%) had increased TAI. 40% of those with decreased TAI required reintervention within 1 year compared with 30% of those whose TAI increased or remained unchanged. Our study demonstrated post-procedural TAI plateaus after 20 days, suggesting that immediate baseline studies may not accurately reflect the peak interventional benefit. However, when serial studies are performed, decreased TAI may help identify patients who require reintervention.

#### "It's my normal": A Linguistic Analysis of In and Outgroup Perceptions of PTSD in Young Adults

#### Hannah Brown Sponsor: Vaidehi Ramanathan-Abbott, Ph.D. Linguistics

Post traumatic stress disorder (PTSD) occurs due to undergoing a traumatic event or multiple events over time. The invisible nature of PTSD makes it very hard to know someone has it without the use of language, lending it well to linguistics research. Building on previous work (Hoyt 2020) exploring linguistic markers of PTSD and the role of repetition and recontextualization in recovery (Ramanathan, 2015; Thompson, 2016), this research performs an initial comparison of in and outgroup perceptions of PTSD and the recovery process through a pilot study involving six young adults. Of particular interest are each group's definitions of PTSD and recovery and the presence of implicit linguistic markers of group membership. To explore this, the participants' interviews are analyzed with attention to emergent themes and word choice. First, I find a mismatch between in and outgroup perceptions of the challenges associated with PTSD; outgroup members focused more on others' perceptions and ingroup members more on internal loss of agency. I also find a significant difference in how members of each group use words related to normalcy, pointing to the conclusion that-for participants in this initial studyrecontextualizing the meaning of "normal" may play a role in PTSD recoverv.

#### Caitlin Brown Sponsor: Francisco Arsuaga, Ph.D. Molecular & Cellular Bio

Infection of individuals by SARS-CoV-2, the virus responsible for the disease COVID-19, varies greatly in its manifestation. While many individuals remain asymptomatic, some develop severe respiratory symptoms and much of this mechanism is still unknown. Evidence suggests part of the answer may lie in the viral structure itself. A region of particular interest is the receptor binding domain (RBD) of the viral spike (S) protein which binds to the human Angiotensin-converting enzyme 2 (ACE2) and ultimately leads to infection with SARS-CoV-2. Understanding the dynamics of this protein docking will help predict potential mutations of the novel coronavirus and may illuminate genetic factors influencing the symptomatic heterogeneity. In this paper, I curate a dataset of RBD genomes with both observed and artificially generated variants, render them in a threedimensional space that accounts for the atoms' biophysical properties (voxelization), and use them to train and test a backpropagation neural network. The network will predict the binding affinity resulting from different mutations to the RBD. Ultimately, these results pave the way for identifying deadly theoretical mutations to SARS-CoV-2 before they emerge by natural evolution, and allow public health officials to prepare accordingly.

# Quantifying Changes in Gene Regulation Across Cell Types

*Ryan Buchner* Sponsor: Gerald Quon, Ph.D. Molecular & Cellular Bio

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

#### A Glance into Light-sensing Mechanisms: Light-induced Destruction of PIF3 Transcription Factor

### **Ryan Buchner** Sponsor: Nitzan Shabek, Ph.D. Plant Biology

A fundamental requirement for the evolution of life on earth is the capacity to recognize light; this ability is not just paramount to the survival of animals, but also for plants as they require light as an energy source. Plants use their ability to sense light to switch between different modes of growth, growing elongated stems and a lesser number of chloroplasts when in the absence of light. This ability allows germinated seedlings to focus their energy stores on the task of reaching the surface to find light. The molecular mechanisms behind this transition have not yet been fully deciphered; in my research, I look to better understand this process by attempting to discover the structure of two of the proteins involved in this process, PIF3 and EBF1. This knowledge would allow us to fill in gaps in scientific knowledge and also possibly allow for the creation of new biotechnological tools.

# Part Preparation and Cable Routing within a CubeSat

#### Napsia Buddhamatya Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

REALOP is the first UC Davis undergraduate-based CubeSat team with a launch scheduled for late 2021. Under mission REALOP, the Structures team has developed a cable harnessing model and prepared a process for manufacturing. More specifically, the parts preparation subteam is responsible for manufacturing preparation as well as creating validation and verification documents. The cable harnessing subteam is responsible for acquiring cable lengths and organization for use in electrical wiring. For parts preparation, drawings of every component as well as tolerances were made for use in manufacturing. Then Interface and Control Documents (ICDs) were developed to detail how each component interfaces with one another during assembly. Mechanical Part Inspection Documents (MPINs) were also created to verify if the manufacturers made the components correctly. For the cable harnessing subteam, Solidworks was used to provide a reasonable representation of the wiring in the CubeSat in order to obtain wire lengths. Drawings of the wire lengths were then generated for use by the electrical team. Both teams in tandem provide a basic schematic of how the CubeSat is assembled, but more importantly also expose members to the documentation and practices that go into spacecraft development, increasing the efficiency of developing future CubeSats.

# Global Composition of Bacteriophage Community in Honeybees

*Taylor Busby* Sponsor: Joanne Emerson, Ph.D. Plant Pathology

Honeybees are a vital component of natural and agricultural systems around the world. With continuous exposure to pollution, pathogens, and parasites, it is necessary to find a way to preserve these colonies without negatively affecting their wild counterparts. This study evaluates the viral community present in honeybees to provide a backbone for future work on the microbiome's potential as a mode of colony control and protection. We utilized both Illumina and PacBio sequencing on viral isolates from a Texan honeybee gut. We have identified many bacteriophages and are analyzing their genomes. The results are currently being compared with two other studies that performed a similar analysis on honeybee colonies in Belgium and Switzerland. Because those groups did not utilize PacBio this will also allow an analysis of the efficacy of PacBio technology and how it may benefit other metagenomic sequencing projects. This research project is ongoing, and we are discovering that the bacteriophages are related to the relatively simple bacterial composition of the gut microbiome. The information that has been collected on their lifestyles, host ranges, and metabolic potential suggests that these phages are ideal for further evaluation for their potential to coordinate honeybee biochemistry and potentially act as tools of protection.

#### Part Preparation and Cable Routing Within a CubeSat

### **Richard Butcher** Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

REALOP is the first UC Davis undergraduate-based CubeSat team with a launch scheduled for late 2021. Under mission REALOP, the Structures team has developed a cable harnessing model and prepared a process for manufacturing. More specifically, the parts preparation subteam is responsible for manufacturing preparation as well as creating validation and verification documents. The cable harnessing subteam is responsible for acquiring cable lengths and organization for use in electrical wiring. For parts preparation, drawings of every component, as well as tolerances, were made for use in manufacturing. Then Interface and Control Documents (ICDs) were developed to detail how each component interfaces with one another during assembly. Mechanical Part Inspection Documents (MPINs) were also created to verify if the manufacturers made the components correctly. For the cable harnessing subteam, Solidworks was used to provide a reasonable representation of the wiring in the CubeSat in order to obtain wire lengths. Drawings of the wire lengths were then generated for use by the electrical team. Both teams in tandem provide a basic schematic of how the CubeSat is assembled, but more importantly also expose members to the documentation and practices that go into spacecraft development, increasing the efficiency of developing future CubeSats.

#### A Novel Database Driven Method for Discovering New Co-based Ferromagnets

#### *Journey Byland* Sponsor: Valentin Taufour, Ph.D. Physics

There exists a wide array of uses for hard and soft ferromagnetic materials in industry. Magnetic elements are rare, and the best way to predict novel magnetic materials is to constrain a search to analyzing the magnetic properties of compounds containing iron, cobalt, and manganese. However, while many databases exist for the purposes of analyzing structural properties of compounds, any such database of magnetic materials that exists is either outdated or incomplete. This study aims to systematically gather the magnetic properties of 13.796 compounds containing the element cobalt, and as of now, a total of 1.341 ferromagnetic compounds have been found and catalogued. These data were collected with the structure data and atomic content of each compound, and trends were analyzed to predict novel ferromagnetic and anisotropic compounds. From this, previously unstudied members of the Cu2MnAl, and La6Co11Ga3 structure types were confirmed to be ferromagnetic with Curie temperatures at or above room temperature, with others still being studied to check for ferromagnetism and uniaxial anisotropy. The research was supported by the Critical Materials Institute, an Energy Innovation Hub funded by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Advanced Manufacturing Office.

#### Co-occurrence Statistics From Vision and Language Capture Thematic Relationships Between Objects

*Ruilin Cai* Sponsor: Joy Geng, Ph.D. Psychology

Thematic relationships have been defined as the grouping of objects together by virtue of their complementary roles in the same scenario or event. We examined the extent to which an unsupervised machine-learning algorithm trained on object cooccurrence statistics could capture thematic relationships between objects within events. We asked Mturk workers (n=240) to list the most common objects found in 24 events. We then trained several models with a continuous-bag-of-word (CBOW) architecture, but with different training corpora. The primary question of interest was whether human ratings for objects belonging to common themes were better described by training on visual scenes or text description. Vision-based models were trained on a database of over 22k densely segmented real-world and photorealistic scenes. Languagebased models were trained on a database of over 2.6 billion websites, wikipedia pages, and news articles. We found that object rankings provided by language based models were more strongly correlated with human rankings of objects than the rankings provided by image-based models. Together these findings reveal the need to reexamine the way in which we define thematic relationships, and point towards the importance of understanding the impact of both visual and textual inputs.

# The Influence of Classroom Language Environment on Bilingual Language Proficiency: Mexican-American and Chinese-American Dual Language Learners in Head Start

# *Xiaoyu Cai* Sponsor: Yuuko Tonkovich, Ed.D. Education

Research shows that classroom language has a role in children's language development with both monolingual and dual language learners (DLLs), particularly for children from lowsocio-economic homes. The limited past studies that examine classroom language have focused on Spanish-English DLLs. However, DLLs are a heterogeneous group and more research needs to be done with DLLs from other language backgrounds. This study examines (a) the difference between Mexican-American (MA) and Chinese-American (CA), (b) the effect of lead teacher verbal communication on DLLs' language skills, and (c) correlation between the frequency of English language and heritage language (HL) use by lead teachers and DLLs. Classroom language environment was assessed using the Language Interaction Snapshot (LISn) that captures language interactions of a total of 12 MA and 13 CA preschoolers in Head Start settings. Each participant was observed for 5 snapshots for a total of 25 minutes between spring and summer 2019. Each child's oral proficiency was assessed using the Woodcock-Johnson IV Tests of Oral Language. Preliminary results show that teachers with CA DLLs spoke in HL more than teachers with MA DLLs. CA DLLs also talked to their teachers in HL more frequently than MA DLLs. Implications for educators will be discussed.

# Sclerotinia Minor in Ornamental Cutting Flowers in California

Jesica Calderon Sponsor: Cassandra Swett, Ph.D. Anr Plant Pathology

In 2019, ornamental flowers: foxglove and scabiosa were sent to the Field and Vegetable Pathology Diagnostics lab at UC Davis from San Luis Obispo County. The plants exhibited brown discoloration, soft rot of the crown and lower stem, presence of white mycelium and black sclerotia. Sclerotinia minor was isolated from infected plants. S. minor is a soilborne pathogen which colonizes host root and stem resulting in degradation of the crown and vascular tissue. Once present in a field it can be difficult to manage. This pathogen has not been reported in these ornamental crops in California. To confirm the pathogenicity of the isolates recovered, foxglove and scabiosa plants were inoculated with two different S. minor isolates recovered from the samples sent in 2019. Symptom development in inoculated plants appear consistent with the plants where S. minor was originally recovered from. To complete Koch's postulates, pathogen isolations from symptomatic plants are underway. By confirming the presence of S. minor, we can classify it as a new pathogen in ornamental flowers in California. Information learned will be useful for growers, farm advisors, and diagnosticians to expand their search range when monitoring for disease.

#### Identifying Strengths and Barriers Faced by Latinx Parents of Children With Special Needs

### Cristavel Camacho-Gutierrez Sponsor: Yvette Flores, Ph.D. Chicano Studies

Latinx immigrant parents may arrive in the United States with an optimistic attitude toward the challenges that await them, but too often they lack the necessary skills to access resources and services that may support their children's academic success. Having a child with special needs further complicates this process. Moreover, the ongoing Covid-19 health crisis has exacerbated these preexisting challenges and created additional barriers for parents to navigate. My research aims to detect and explore the barriers that Latinx families with children with special needs encounter, while also recognizing the familial cultural resources that they may have. I will conduct a qualitative study through telehealth, which will consist of semi-structured interviews to be carried out with Latinx parents of children with special needs. My research will illuminate some of the current challenges faced by this particular group of parents while identifying their resiliency and desire to organize. My findings will shed light on areas of further research and may have policy implications to reduce barriers for immigrant parents.

# Motion Categorization in Children With Upper Limb Differences

*Nicole Campbell* Sponsor: Wilsaan Joiner, Ph.D. MED: Neurology

Despite the numerous commercially available adult prosthetic devices, current options for children with upper limb differences have largely failed to show significant quality of life improvements. Myoelectric devices, which use some of the most reliable advanced designs, are abandoned by children twice as frequently as adults. Thus, developing novel control schemes that are reliable, robust, and easy to learn is critical for the next generation of pediatric prostheses. Sonomyography (i.e., the use of ultrasound imaging to detect muscle deformations) paired with machine learning classification algorithms has been shown to be a promising candidate for adult prosthetic control. Here, we developed a testbed for this control in pediatric patients by integrating a classification algorithm (K-Nearest-Neighbor, KNN) with a custom, 3D printed, low-cost powered prosthetic hand. The long-term goal is to use this setup to assess the motor control abilities in patients being treated at Shriners Hospital for Children; examining how early development affects control and is gradually refined in patients with congenital upper limb differences.

*Ricardo Cantua* Sponsor: Elva Diaz, Ph.D. MED: Pharmacology

Synaptic plasticity underlies learning and memory at the neuronal level. Long-term potentiation (LTP), a specific process of synaptic plasticity, is characterized by increased synaptic AMPA receptors (AMPARs) through targeting of non-synaptic reserve AMPAR pools. The type II transmembrane protein Synapse Differentiation Induced Gene 1 (SynDIG1) was identified to interact and cluster with AMPARs by usage of an N-terminally HA-tagged construct. To study this protein, we made a construct containing an untagged version of SynDIG1. This construct was sequenced and transfected into COS-7 cells. which were then immunoblotted. These assays confirmed the presence of SynDIG1 in the plasmid and its expression in mammalian cells. We are also constructing two plasmids containing SynDIG1 C-terminally tagged with different fluorescent proteins (SEP or pHuji). These proteins were selected for their similar pH dependence and ability to be imaged simultaneously in living cells. These constructs will be used in future experiments to assess the function of SynDIG1 in AMPAR trafficking during LTP. The untagged construct will be useful in experiments with temperature-dependent regulation of endocytosis while the fusion constructs in live-imaging of SynDIG1 and SEP-GluA1 or SynDIG4-pHuji. By exploring these mechanisms, we hope to gain insight into the complexities of learning and memory.

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

*Trevor Carpenter* Sponsor: Setareh Rafatirad, Ph.D. Engr Computer Science

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

#### Is it Gato or Gatito? Diminutives in Spanish-English Bilingual Infant-Directed Speech

#### Jessica Carrasco Sponsor: Katharine Graf Estes, Ph.D. Psychology

Caregivers play a crucial role in infants' language experience. Infant-directed speech (IDS) includes features like slow speech rate, higher pitch, and word repetition than adult-directed speech (ADS). It's believed that this speech register facilitates language learning. However these features are from monolingual studies. We know very little about bilingual IDS. The IDS literature suggests that diminutive words (i.e., kitty) is another feature frequently used by parents talking to their infants. Diminutives may facilitate lexical learning because they regulate the prosodic shape of words, helping infants segment and learn words in their languages. The purpose of this study is to explore diminutives with Spanish-English bilingual parents and English-speaking parents. Eight-to-20-month-olds and their parents (N = 40) participated in a set of interactive tasks containing objects labelled with target words in English (for monolinguals) or English and Spanish (for bilinguals). From coded transcripts of the sessions, we will analyze the frequency of diminutives use by parents. We predict bilingual parents will use more diminutives than monolingual parents because it is common in Spanish for IDS nouns to be diminutivized. We will test whether bilingual parents produce more diminutives in English than monolingual English-speaking parents, suggesting an influence of the bilinguals' Spanish knowledge.

#### Investigating the Effects of Advanced Diabetes and Aging on Pancreatic Alpha Cells

#### *Vincent Castillo* Sponsor: Mark Huising, Ph.D. MED: Physiology & Membrane Biol

Diabetes is a devastating disease for individuals of all ages, but in particular for elderly individuals where mortality rate is significantly increased by diabetes. A feature of type 2 diabetes is that glucagon, a counterregulatory hormone from islet alpha cells, is found in excess at an early stage, and is later hyposecreted in advanced diabetes. I hypothesize that the combination of diabetes and aging induce a change in alpha cell responsiveness that underlies glucagon dysfunction seen clinically. To test this hypothesis, I will be using a calcium sensor, which is highly correlated with exocytosis, expressed in alpha cells to measure cell activity. Through this I will record their responses to specific physiological cues, such as epinephrine, arginine vasopressin, amino acids and glucose and look at how responses change with age (young/old) and disease state (lean/diabetic). As expected, I observed that aging alone doesn't affect glucose sensitivity in mice. However, we expect that the combination of diabetes and aging will induce a change in alpha cell responsiveness. These experiments will contribute a better understanding of the fundamental differences in alpha cells as a result of age and diabetes with the goal of improving treatments and extending longevity in those with diabetes.

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# Investigating Processing of Sentences Containing Covert Racialized Adjectives

*Isaias Ceballos III* Sponsor: Maria Ferreira, M.D.,Ph.D. Psychology

Have you ever felt uncomfortable hearing President Obama referred to as "articulate"? Racially coded language is not always obvious. This project investigates how racialized adjectives affect language processing. We will administer a survey in which we ask subjects to list adjectives that vary in offensiveness. Following the survey, we will conduct a rating study on a Likert scale where the polar opposites of the scale are "not offensive" or "extremely offensive" and we will gather the responses in the middle to examine how covert linguistic microaggressions affect processing. We also will conduct a selfpaced reading study in which participants read sentences wordby-word. We intend to compare sentences with and without racialized adjectives and also compare sentences where the referent matches the intended covert microaggression (e.g., articulate Barack Obama vs articulate Bill Clinton). For this selfpaced study, we predict that sentences with racialized adjectives that also match the intended referent will be processed faster because there is a match of stereotyped knowledge between the adjective and who the racialized adjective is referring to. This work is important because it will allow us to identify these more subtle racialized adjectives and to assess their effects on real-time language processing.

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

#### Charlene Chan Sponsor: Neil Hunter, Ph.D. Microbiology & Molec Genetics

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

# Effects of Lactoferrin on Placental Development

Sandra Chan Sponsor: Bo Lonnerdal, Ph.D. Nutrition

Lactoferrin (Lf) is an iron-binding protein, found in human secretory fluids, such as amniotic fluid. Lf is a pleiotropic protein involved in various bioactivities, including cell proliferation and differentiation. Lf may contribute to placental development since a high concentration of Lf appears in the human trophoblast. Currently, effects of Lf on placental development remain unclear. Here, we hypothesized that Lf promotes placental development. To address this hypothesis, a mouse model and a human trophoblast cell model (BeWo cells) were used. Lf expression in different mouse tissues was first analyzed by isolating RNA from different mouse tissues/organs including mammary gland, bone marrow, liver, and placenta for gRT-PCR analysis. The results showed high concentrations of Lf transcripts in the placenta. To determine functions of the abundant Lf in the placenta, BeWo cells were treated with Lf (50-250 µg/mL) for 72 h and then effects of Lf on placental differentiation were evaluated by qRT-PCR of two trophoblast differentiation markers, human chorionic gonadotropin ß-unit (hCG-ß) and hSyncytin-2. The results showed that Lf treatment significantly up-regulated transcription of these two differentiation markers. Put together, Lf is abundantly present in the placenta during pregnancy and may promote placental differentiation.

Helena Chan Sponsor: Prabhu Shankar, M.D. MED: Public Health Sciences

The ongoing COVID-19 pandemic has plagued Yolo County and Sacramento over the past year. As recommended by the Center for Disease Control, an understanding of the symptoms of the disease is necessary to take control measures and prevent spread of the infection. The majority of the mainstream information about COVID-19 symptoms only available in the English language, and families with Limited English Proficiency (LEP) are left at a disadvantage. Creating a multilingual platform can increase accuracy of symptom capture through the translation of healthydavistogether.com COVID-19 symptom tracking and important information about vaccination. The project information will be translated into the popular languages spoken in Yolo County which will be compiled both into a digital library, as well as into a pamphlet in English and other most commonly spoken languages. The symptoms will be depicted with images and checkboxes. The commonly used representations of the disease manifestations will be mapped to the currently used English terms, as well as SNOMED-CT vocabulary. If successfully implemented and maintained, this project will increase awareness, data accuracy, strengthen research, and encourage LEP population participation in COVID-19 public health preventative measures. The model could be generalizable to any future threats by illnesses to public health.

#### Quantification and Structural Analysis of Cell Glycogen Using Liquid Chromatography-Mass Spectrometry-Based Methods

Vincent Chang Sponsor: Carlito Lebrilla, Ph.D. Chemistry

Glycogen is the storage form of glucose in animals and humans and has important roles in both regulating blood sugar levels and supplying energy to cells. Because of these key roles, many studies aim to elucidate the effect of enzymes and hormones on glycogen storage and utilization by extracting and quantifying glycogen from cells and tissues. Currently, most glycogen assays are based on colorimetric and fluorometric methods, which quantify total carbohydrates instead of glucose from samples, and provide little to no structural information on glycogen. Herein, we present a workflow for extracting glycogen from human liver cancer cells (HepG2), guantifying glycogen by specifically measuring glucose from extracted glycogen, and elucidating structural information of glycogen such as the degree of branching using ultra-high-performance liquid chromatography coupled with triple quadrupole mass spectrometry (UHPLC-QqQ MS). By using this workflow, the monosaccharide and glycosidic linkage composition of the cell glycogen were determined, and four commercial glycogen standards and amylopectin were also analyzed for structural comparison and method validation. Other studies that aim to better understand the effect of enzymes and hormones on glycogen metabolism or better diagnose glycogen storage disorders can apply the methods presented in this study for comprehensive glycogen analysis.

#### A Structurally Defined Pea Fiber Snack Alters the Human Fecal Metabolome.

#### Jessica Chao Sponsor: Carlito Lebrilla, Ph.D. Chemistry

The western diet is characterized by high saturated fat and sucrose consumption and low fiber consumption. It further correlates with an increased rate of morbidity. It is known that this diet modifies the gut microbiota and it further impacts human health through these modifications. Fiber is an important and necessary component of diet. Despite the importance of fiber, relatively little is known regarding the chemical structures of fiber and how these structures impact human health. To unravel how dietary fiber affects the gut microbiome and the produced metabolites, targeted metabolomics were performed on human fecal samples from a well-defined feeding study. In this study, 12 participants were placed on a controlled high saturated fat and low fruit and vegetable (HiSF-LoFV) diet for 6 weeks. Participants were then given a pea fiber snack on weeks 3 and 4 as a supplement to their controlled diet. Fecal samples obtained from each week were subjected to derivatization with benzoyl chloride and 2-picolylamine before a targeted UHPLC-QqQ-MS analysis. This work will further our understanding of how defined fiber structures may selectively alter the gut microbial metabolome and thus their effect on health.

# Aedes aegypti Mosquito Behavioral Thermoregulation: Implications for Understanding Viral Transmission Dynamics

*Claire Chapman* Sponsor: Christopher Barker, Ph.D. VM: Pathology, Micro, & Immun

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

### A Meta-analysis of the *Ralstonia* Species Complex Diversity, Geographic Distribution, and Host Range

#### Maria Charco Munoz Sponsor: Tiffany Lowe-Power, Ph.D. Plant Pathology

The Ralstonia Species Complex, also first known as Ralstonia solanacearum, consists of soil-borne bacterial pathogens that cause bacterial wilt disease in many plants including major crops like potato and tomato. Bacterial Wilt Disease is characterized by a disease that clogs the vascular system of plants that results in leaves to wilt. The purpose of this meta-analysis study is to analyze a diverse range of Ralstonia strains, it's world-wide distribution and the broad range of hosts it impacts and that relates to pathogenicity. At present, I am analyzing peer-reviewed literature that include data on Ralstonia Species Complex strains on a taxonomic system of classification known as phylotype-sequevar system. I have catalogued the isolation locations, isolation hosts, and phylotype-sequevar of over 500 strains. The strains were isolated from over 50 distinct geographic regions, over 40 distinct hosts, and were identified as members of over 30 distinct sequevars. The work on this study is still in progress as more literature is analyzed and information of the strains of Ralstonia are categorized. However, based on the preliminary data, I hypothesize that Ralstonia phylotype II strains are more widely distributed than phylotype I strains.

# Development of a Rotational Testbed For Cubesat Imaging Slew Requirements

*Ipsita Chauhan* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

This presentation discusses the research and development of a motorized rotation testbed to define reaction wheel slew requirements in support of UC Davis' REALOP CubeSat mission. One critical goal of the REALOP mission is to capture clear images of the Earth from low Earth orbit (LEO), requiring finely tuned attitude control from the on-board reaction wheels to limit motion blur. This performance requirement was investigated using a microstepping motor to simulate a one degree-offreedom rotational environment for testing the image quality of a Raspberry Pi V2 Camera Module. Through varying the camera's angular velocity, exposure, and ISO, images were captured and then qualitatively analyzed to determine the rotation threshold that the satellite's reaction wheels must maintain to return clear pictures from LEO. Experimental results found a maximum rotation rate of 20°/s and an exposure time of 100 µs at ISO 200 suitable for successful imaging efforts. While the motor step resolution constrained the rotational smoothness of the testbed, this design demonstrates a low-budget option for student teams investigating CubeSat imaging attitude control requirements. The use of an environment more similar to that of LEO, such as a frictionless air-bearing table, is recommended to better simulate unconstrained rotation.

#### An Empirical Analysis of How Different Face Portions Affect Emotion Recognition Through Machine Learning Models

# Yu-Shih Chen Sponsor: Daisuke Sato, Ph.D. MED: Pharmacology

Emotion recognition is a crucial skill for humans. However, we do not know precisely how it functions. This study investigates the importance of different facial features by analyzing predictions made by machine learning models. Our analysis of the saliency maps generated from the learned Le-Net 5 convolutional neural network (CNN) model provided us with initial motives to investigate and compare the CNN model results on different portions of the face. From our results of the various numerical experiments, we concluded that a stronger preference for the lower portion of the face than the upper portion, which matches our saliency analysis. The result is quite intuitive as the area around the face's mouth portion does seem to act as a strong indicator of emotions. Furthermore, the left portion of the face seemed to be on par with the right portion of the face in terms of affecting the model performance. These results could be interesting to future emotion recognition research.

#### Incidence and Characteristics of Small Intestinal Bacterial Overgrowth and Pancreatic Insufficiency in the Bariatric Surgery Population at UC Davis

*Alexis Chirco* Sponsor: Victoria Lyo, M.D. MED: Surgery

Obesity is a major health problem affecting over 40% of Americans. Bariatric surgery can safely and effectively help patients achieve weight loss. However, small studies have suggested that following surgery, 40% of patients develop small intestinal bacterial overgrowth (SIBO) and 31% develop pancreatic insufficiency (PI). This study investigates the incidence and clinical outcomes of SIBO and PI in bariatric patients at UC Davis. A retrospective chart review was performed to collect clinical data and test results for bariatric patients suspected of having SIBO and/or PI based on gastrointestinal symptoms. Out of 60 patients we have analyzed so far, 81% experienced diarrhea, 66% abdominal pain, and 46% bloating after surgery. Of these patients, 26% tested positive for SIBO and 25% tested positive for severe PI. These results suggest that SIBO and PI are common among bariatric surgery patients with suggestive symptoms. A high degree of clinical suspicion for these diseases is warranted while managing these patients post-operatively. Ultimately, patients presenting with these gastrointestinal symptoms should receive SIBO and PI testing to expedite treatment. Further research into the risk factors and causes of these diseases after bariatric surgery as well as their potential for prevention and optimal treatment is necessary.

# Locating Nostalgia in Time and Space: The Colors of Seishun (Youth) in Japanese Cinema

Aska Melody Chong Sponsor: Michiko Suzuki, Ph.D. East Asian Lang. & Cultures

Nostalgia is an experience of intense and unresolvable longing motivated by general sentimentality and/or attachment to specific objects. In films, nostalgia functions to create a fictional on-screen reality using audio-visual cues that freely manipulate time and space. These on-screen worlds manifest varying degrees of nostalgia that affects the audience both collectively and personally during and beyond film viewing. Japanese films build uniquely nostalgic cinematic worlds that specifically appeal to a culturally Japanese audience. They provide a heavily emotionally charged film-viewing experience by employing various significant symbols that build up either a vague or concrete sense of nostalgia, as seen in the two films Drowning Love (2016) and Sunny: Our Hearts Beat Together (2018). These films also thematize a romanticized view of adolescence, seishun (??), to tell a nostalgic narrative. Furthermore, although nostalgia is often interpreted as a longing for the past, it transcends time and space and, in this way, adds affective depth to the modern cinematic experience.

#### Species coexistence in randomly switching environments

### Tabib Chowdhury Sponsor: Sebastian Schreiber, Ph.D. Evolution & Ecology

According to the competitive exclusion principle, two species competing for space cannot coexist under equilibrium conditions. However, when environmental conditions fluctuate and favor different species at different times, coexistence is possible. To better understand when this can happen, we constructed a model to simulate the dynamics of competing species in a stochastic environment. We put together a piecewise deterministic Markov process (PDMP) in which the densities of the two species are governed by systems of linear differential equations that randomly reset whenever the populations reaches a critical density. Analytical conditions for stochastic coexistence and exclusion, were found using Lyapunov exponents which correspond to per-capita growth rates when rare. Conditions for ergodicity, which corresponds to a unique long term statistical behavior for coexisting species, are currently being established. We are also in the process of constructing a more periodic model to compare the long term behavior of species coexistence between a stochastic and a periodic environment.We demonstrate our results using numerical simulations.

#### Blake Christierson Sponsor: Farhad Assadian, Ph.D. Mechanical & Aerospace Engr

Motorsports simulation involves modeling a large set of complex nonlinear subsystems to accurately predict vehicle behavior near the performance limit. The computational cost of addressing these intricacies becomes unmanageable when attempting to design the hundreds of parameters that describe high fidelity vehicle models. To circumvent this, Formula Racing at UC Davis (FRUCD) has implemented a set of multifidelity chassis. tire, suspension, controls, powertrain, and aerodynamics models. This model library allows vehicle models to be tailored to specific design applications by reducing complexity in negligible subsystems. Additionally, the multifidelity models facilitate the sequential refinement of the vehicle's design by exploiting cheap models to refine high fidelity search spaces. Furthermore, programs for steady state, transient, and lap time simulation are being developed to facilitate varied cost evaluation providing both quick and comprehensive design analyses. These toolsets seek to expand FRUCD's tractable design spaces by more efficiently utilizing computational resources through flexible simulation.

# Me, the Floor, & the Rhythm

*Ruth Christopher* Sponsor: Margaret Ronda, Ph.D. English

Me, the Floor, & the Rhythm is a poetry collection grown out of the traditions of confessional/spoken word poetry. It is based in my study of such poets as Sylvia Plath, Audre Lorde, Andrea Gibson, Ada Limon, and Saul Williams. My collection explores such themes as embodied female experience, dance, sexual & religious trauma, eating disorders, and familial inheritance (conscious or otherwise). Me, the Floor, & the Rhythm has a tripartite construction, arranged thematically using the Sonata structure from classical music: Exposition, Development, and Recapitulation. Within this the poems are arranged by tempo: Andante con moto or walking tempo, Allegro or fast, and Sensualmente or sensuously. With this collection I have tried to push the bounds of confessional poetry, to be brutally honest with myself in ways that females are often not allowed to be, to say things that we are not permitted to say. At the same time, confessional poetry is not just for exploring trauma and the darkest recesses of our natures. It also gives space for the expression of love, joy, sublimity, vulnerability, and everything in between. For this reason I have also included many poems about dance (the other art that I practice) and my lover.

### The Impact of COVID-19 on the Mental Well-Being of the Asian Pacific Islander American (APIA) Population Ages 18-30 Residing in Yolo and Sacramento, California

Valerie Chu Sponsor: Christian Bohringer, M.D. MED: Anesth & Pain Medicine

Coronavirus disease 2019, or COVID-19, is an infectious communicable respiratory illness that has affected over 100,000 people throughout Sacramento and Yolo County. During the pandemic, social distancing and lockdown measures were put in place to ensure the safety of our communities. Mental health issues have become relatively common in the youth group due to social isolation. Our aim is to investigate, to what degree has COVID-19 impacted the mental well-being of the Asian & Pacific Islander American (APIA) community, ages 18-30, residing in the Yolo County and Sacramento City/County, CA region compared to the Caucasian population? Our online survey asks participants to rate statements based on their mental health, healthcare access, and academic performances. Our survey was opened from January 20th, 2021 to February 3rd, 2021. Our sample group (n = 147) consisted of 32 participants identifying as Caucasian and 94 participants identifying as Asian/Pacifier Islander. Our data suggest that Caucasian and APIA communities are experiencing depressive symptoms. However, the APIA community reported having a higher impact of negative effects related to depression, anxiety, mood, and stress levels. In conclusion, there should be more resources to support the APIA community regarding their mental well-being, especially during this time.

# Images of the (Post)Colonial: Acts of Killing and Symptoms of Trauma in Malaysia and Indonesia

*Kymberley Chu* Sponsor: Tarik Elhaik, Ph.D. Anthropology

I aim to study photographs and films of uprisings, historical decolonial events, and urban landscapes in Malaysia and Indonesia. Building on what is currently called the anthropology of images, I am analyzing aesthetics and how image-events are seen as political processes, circulatory materials that encourage acts of resistance. In addition, I draw from the tradition of political anthropology to discuss how specific political moments in Malaysia (e.g. 2015 Bersih protests) and Indonesia (e.g. 1965-1966 Indonesian Mass Killings) emerge in the context of historical decolonization, political memory, and trauma. Using a comparative and curatorial perspective, I look at the emergent forms of political resistance, capitalistic urban lifestyle, and signs of political violence-inflicted trauma. Acts of political activism and resistance in both countries are not strictly influenced by foreign colonialism and western hegemony exclusively. For example, Malaysia's various ethnic groups exercise their ways of belonging and challenge corruption in opposition to Malaydominated authoritarianism. In Indonesia. Joshua Oppenheimer's film, The Act of Killing, demonstrates how a spectatorial logic of shame affects the cinematic practices of portraying trauma. The film shows how perpetrators and victims interact after the 1965-1966 Indonesian Mass Killings. This research is for my undergraduate honors thesis in anthropology.

#### Adaptation of a Tetracycline-Inducible System for Use in *Giardia lamblia*

#### *Katie Chun* Sponsor: Scott Dawson, Ph.D. Microbiology & Molec Genetics

Giardia lamblia is a binucleate parasitic protist and is responsible for a severe diarrheal disease, giardiasis. This organism is the most common protozoal intestinal parasite isolated worldwide and is associated with poor water quality. Despite its significance in global health, much is left to be discovered about how the parasite colonizes and infects its host. Giardia has a unique microtubule-based cytoskeleton that consists of eight flagella and a ventral disc, the latter being essential for attachment to the host intestine upon infection. Past research in the Dawson Lab has identified several essential cvtoskeletal proteins through gene knockdown with the CRISPR interference system, but the mechanism behind disc function remains elusive. To further study Giardia's cytoskeleton, I adapted the tetracycline-inducible system for Giardia, allowing observation of real-time expression of any protein variant or mutation. I tested the system by inducing mNeonGreen fluorescence in Giardia's two nuclei and observing through microscopy. Results indicated that the tetracycline-inducible system was successful in inducing fluorescence in over half of Giardia cells. Further research will consist of optimizing the efficacy of this system and combining it with other constructs to analyze disc assembly and knockdowns using CRISPR interference.

# Examining Speech Toward Alexa versus humans: A comparison of adults and children

*Eva Clubb* Sponsor: Georgia Zellou, Ph.D. Linguistics

Voice assistants such as Alexa and Siri are now commonly used in the home and everyday life, yet our scientific understanding of these interactions is still in its infancy. This study tests how people of different ages (college-age adults and children, ages 7-12) talk to an Alexa device versus a human. The interactions, conducted over Zoom due to social distancing restrictions, were controlled so that participants said the same sentences to the Alexa and human interlocutors. Subjects see a list of 24 words and, on each trial, the experimenter or device asks what the next word on the list is. The subject replies with the corresponding word on their list ("The word is pig"). Then, the experimenter or device says the word back and asks the subject to repeat the sentence; on 4/24 of trials, the interlocutor mishears the pronunciation, saying a second word with a consonant error ("I heard pig or pick"). Videos are annotated in ELAN and manually checked. We predict that adults and children will show differences in the way they adjust their speech for a human versus Alexa interlocutor. Broadly, this work can reveal the impact of voice assistants on language behavior across the lifespan.

# Induction of phenylpropanoid metabolism as a biomarker of early *Botrytis cinerea* infection in ripe strawberries

Benjamin Cohen Stillman Sponsor: Barbara Blanco-Ulate, Ph.D. Plant Sciences

Botrytis cinerea is a ubiquitous fungal pathogen that causes losses up to 90% in ripe strawberries (Fragaria x ananassa). Biomarkers of early disease, including metabolic changes in ripe fruit during infection, can be used to develop accurate, fast, and non-destructive detection methods for B. cinerea in strawberry production. Profiles of phenolic compounds are known to change upon infection, and detection of these changes during early time points could serve as an indicator of disease. Here, I investigate changes in total phenolic content (TPC) and the underlying expression of biosynthetic genes in B. cinereainfected strawberries. Ripe fruit (cv. Monterev) was inoculated with a B. cinerea suspension, then sampled at four timepoints between 1 and 24 hours post inoculation, with mock-inoculated fruit as control. The same samples were analyzed by RT-gPCR to study the expression of genes involved in the committed steps of phenylpropanoid metabolism. I anticipate changes in TPC that correlate with the expression of phenylpropanoid genes, although the presence of paralogs in the strawberry genome and post-transcriptional mechanisms may obscure connections between gene expression and metabolic activity. Multispectral imaging data of inoculated fruit was also used to characterize temporal and spatial aspects of phenylpropanoid accumulation in early B. cinerea infection.

# Development of a Rotational Testbed for CubeSat Imaging Slew Requirements

Cordell Cohoon Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

This presentation discusses the research and development of a motorized rotation testbed to define reaction wheel slew requirements in support of UC Davis' REALOP CubeSat mission. One critical goal of the REALOP mission is to capture clear images of the Earth from low Earth orbit (LEO), requiring finely tuned attitude control from the on-board reaction wheels to limit motion blur. This performance requirement was investigated using a microstepping motor to simulate a one degree-offreedom rotational environment for testing the image quality of a Raspberry Pi V2 Camera Module. Through varying the camera's angular velocity, exposure, and ISO, images were captured and then qualitatively analyzed to determine the rotation threshold that the satellite's reaction wheels must maintain to return clear pictures from LEO. Experimental results found a maximum rotation rate of 20°/s and an exposure time of 100 µs at ISO 200 suitable for successful imaging efforts. While the motor step resolution constrained the rotational smoothness of the testbed, this design demonstrates a low-budget option for student teams investigating CubeSat imaging attitude control requirements. The use of an environment more similar to that of LEO, such as a frictionless air-bearing table, is recommended to better simulate unconstrained rotation.

#### Investigating the Response to Health-Related Messages Over Social Media

#### Roberto Jr Comandao Sponsor: Debbie Fetter, Ph.D. Nutrition

In the US, about 7 of 10 individuals use social media to seek out information. However, this widespread use of social media means there is an increased risk of finding false information, especially for health-related topics. Message framing is a fundamental component of communication strategy that can influence the exposure of a message. Messages can be framed to emphasize either the benefits of engaging in a behavior (a gain-frame), the consequences of failing to participate in behavior (a loss-frame), or the potential danger of not adopting recommendations (a fear appeal). This study will develop gainframed. loss-framed, and fear-based health messages to investigate the response between a population with high-use of social media versus one with low-use. Participants will complete a survey about their social media use, perceived level of knowledge about these health topics, and responses to these health messages in the different framings. Questions will be included to measure perceived accuracy, how likely they would be to share the message with their social network, and selfefficacy towards behavior change. The results can be used to investigate how to more effectively disseminate health messages over social media to help individuals adopt beneficial behaviors.

#### Prometryn-Induced Oxidative Stress and Vitamin E

# *Liam Condon* Sponsor: Aldrin Gomes, Ph.D. MED: Physiology & Membrane Biol

Research on common pesticides used in the United States has revealed significant induced oxidative stress from these pesticides in fish, plant, and mammalian cells and tissues. Atrazine and 2,4-dichlorophenoxyacetic acid (2,4-D) are two well researched pesticides that have been found to increase oxidative stress as evidenced by increased lipid peroxidation and significantly altered antioxidant activities in cells. The in vitro effects of prometryn, a less common triazine herbicide, have been minimally researched. Additionally, research suggests certain therapeutic agents, including Vitamin E, can alleviate cellular oxidative stress through their antioxidant capacities. In this study I aim to understand the in vitro effects of prometryn on cellular oxidative stress in H9c2 cardiac cells and the effects of Vitamin E on potential prometryn-induced oxidative stress. To compare the relative levels of oxidative stress in each experiment I directly measured the cellular concentrations of reactive oxygen species (ROS) and indirectly measured two other indicators of oxidative stress, lipid peroxidation and superoxide dismutase activity. Preliminary results from the Gomes laboratory suggest prometryn increases cellular ROS levels. Based on these results, I hypothesize that Vitamin E will ameliorate prometryn-induced oxidative stress which will be exhibited through increased ROS, increased lipid peroxidation, and altered superoxide dismutase activity.

#### *Cynthia Cortez* Sponsor: Katharine Graf Estes, Ph.D. Psychology

Caregivers play a crucial role in infants' language experience. Infant-directed speech (IDS) includes features like slow speech rate, higher pitch, and word repetition than adult-directed speech (ADS). It's believed that this speech register facilitates language learning. However these features are from monolingual studies. We know very little about bilingual IDS. The IDS literature suggests that diminutive words (i.e., kitty) is another feature frequently used by parents talking to their infants. Diminutives may facilitate lexical learning because they regulate the prosodic shape of words, helping infants segment and learn words in their languages. The purpose of this study is to explore diminutives with Spanish-English bilingual parents and English-speaking parents. Eight-to-20-month-olds and their parents (N = 40) participated in a set of interactive tasks containing objects labelled with target words in English (for monolinguals) or English and Spanish (for bilinguals). From coded transcripts of the sessions, we will analyze the frequency of diminutives use by parents. We predict bilingual parents will use more diminutives than monolingual parents because it is common in Spanish for IDS nouns to be diminutivized. We will test whether bilingual parents produce more diminutives in English than monolingual English-speaking parents, suggesting an influence of the bilinguals' Spanish knowledge.

# Transformative Voices: Listening to and Learning From the Transgender Communities in Mexico and Peru

*Eric Coyle* Sponsor: Robert Irwin, Ph.D. Spanish & Portuguese

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

#### Computational and Hypothetical Drug Design of HMG-CoA Reductase Inhibitors

#### Joseph Noel Cruz Sponsor: Justin Siegel, Ph.D. MED: Biochem & Molecular Med

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

#### Holy Bodies: Exploring Religion, Culture, Ethics, and Sex Education Inequity among students in the Filipinx diaspora

Jessica Cuenco Sponsor: Jose Ballesteros, Ph.D. Graduate Division

California law defines extensive sexual education as proper instruction on: "Human development and sexuality, including education on pregnancy, contraception, and sexually transmitted infections" (EC § 51931[b]). However, provisions such as consent, discrimination, sexual abuse, and prevention are not under this clause. Previous research has shown a measurable percentage of undergraduate students enter university without an adequate foundation in sexual health education. Notably, BIPOC students are disproportionately affected by a lack of a mandated curriculum on preventing pregnancy, abuse, LGBTQI+ discrimination, and STI transmissions. Focusing on a specific group within the BIPOC community, this case study collects data on Filipinx - identified university students. Research conducted by surveying and interviewing voice the transnational perspectives of these students on their experiences and current knowledge around sex and sexuality. This project also discusses various cultural, religious, and ethical factors within the Filipinx diaspora that may further suggest a disconnect between Filipinx students and their families regarding sex. Thus far, initial findings imply that students hailing from immigrant households lack the necessary support and comprehension from their families. This research attempts to bring awareness to sex education inequity and promote healing and liberation within the Filipinx community.

Jasmeen Dadra Sponsor: Simona Ghetti, Ph.D. Psychology

Episodic memory, or memory for past events with retention of the spatio-temporal context of those events, improves significantly during the second year of life (Bauer & Leventon, 2013). Although the hippocampus has been strongly implicated in episodic memory processes (Vargha-Khadem et al., 1997), only recently has research reported evidence of hippocampal activation in episodic-like memory processes in two-year-olds (Prabhakar et al., 2018). Many questions remain on the role of structural changes in the hippocampus and early memory functioning. We examine the association between volume of the anterior and posterior hippocampal regions and memory performance in two-year-olds. Children participated in a 3-piece puzzle game, assessing their spatio-temporal memory, at two time points, immediately after being shown and after a oneweek delay. At the end of the one-week delay children's source memory, the ability to remember when and where something was learned, was assessed. Neuroimaging data were collected, while toddlers were asleep, within the next three days. Children returned after a delay of several months and participated in the source task preceding the puzzle game. Expected analyses will include correlations among age, hippocampal volume, and performance. Results aim to provide insight on memory over delay and neural correlates of episodic memory development.

#### Determining the Relationship Between Childhood Leukemia and Drinking Water Contaminants

Madeleine Dahlgren Sponsor: Damien Caillaud, D.V.M.,Ph.D. Anthropology

The number of diagnosed childhood leukemia cases are rising each year in the United States. While the cause of most leukemia cases is largely unknown, environmental exposures may be contributing to this trend. One suggested cause is chemical exposure from poor quality drinking water. Currently, the relationship between drinking water contaminants and childhood leukemia incidence remains unclear. This study aims to provide insight into this issue through a multi-state assessment of drinking water quality and childhood leukemia case incidence. Water contaminant violation data from the EPA's Safe Drinking Water Information System (SDWIS) Federal Reporting Services and cancer data from the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (SEER) database were analyzed at the county level for 11 states (n=100 counties). In addition, socioeconomic data from the American Community Survey (ACS) were considered to provide insight into potential community-level effects. Preliminary data suggest that childhood leukemia rates are increasing across our target states. We predict that counties that have more water system contaminant violations will have higher case reports. This research could help identify counties with known water quality issues that may be contributing to health issues among an at-risk population in the U.S.

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

#### *Christine Daniels* Sponsor: Timothy Brelinski, Ph.D. Classics

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

#### Does the Nature of Rotation Matter? Assessing Infants' Mental Rotation in an Online Task.

Ananya Das Sponsor: Lisa Oakes, Ph.D. Psychology

Mental rotation, which is the ability to mentally manipulate and make predictions about an object's orientation, is critical for understanding objects in our daily lives. Previous studies have revealed sex differences during infancy, specifically that boys show greater mental rotation than girls (Moore & Johnson, 2008; Quinn & Liben, 2008, Lauer et al., 2015). The goal of the current study was to assess how the nature of the rotation influences infants' mental rotation. We tested infants using an online platform called Lookit (Lookit.mit.edu) that allows families to participate in studies from home. One-hundred-fifty infants between the ages of 6 and 13 months were tested in a modified version of the task used by Lauer et al. In that task, infants were shown two stimulus streams containing identical tetris-shaped items that repeatedly appear and disappear. On every third presentation one stream contained the mirror image of the item in the other stream. We manipulated the nature of rotation by presenting some trials in which the items rotated sequentially (i.e., continuously and clockwise); the remaining trials were nonsequential and random. Ongoing analyses will allow us to evaluate previously observed patterns in mental rotation tasks, including age and sex-related differences.

### Self-Regulatory Adaptable Desk

#### Julie Daseking Sponsor: Nicole Sparapani, Ph.D. Education

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

# Mechanical and Thermal Analysis of CubeSat Structure for Simulated Launch and Orbital Environments

#### *Giancarlo Datuin* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The Space and Satellite Systems (SSS) club's REALOP mission is to create a 2U CubeSat expected to launch in 2021. The Structures team of SSS has two analysis sub-teams: mechanical and thermal analysis. The goal of both teams is to simulate launch conditions followed by a transient orbit around the Earth to verify CubeSat nominal operations. To create these simulations, the mechanical analysis team uses Solidworks with launch data provided by Nanoracks and Antares while the thermal analysis team uses Thermal Desktop. The thermal analysis sub-team is in the process of preparing a basic model of the CubeSat to showcase the effects of radiation on the external faces of the frame, as well as internal heat transfer between the inner components/faces of the frame. This analysis determines if insulation or a material finish is needed, and verifies that the CubeSat survives in orbit. The mechanical analysis team performed 11 guasi-static tests; including rotational, translational, and vibrational loads using restrictions such as remote loads to obtain Finite Element Model (FEM) mesh stresses and displacements that fall within expectations. The two teams replicate the conditions that CubeSat will undergo through the use of different software to simulate sensible mission results.

#### The Influence of Climate Variables and Disease on Plantago lanceolata Survival

#### Carmen David Sponsor: Jennifer Gremer, Ph.D. Evolution & Ecology

This project is a continuation of a study on the globallydistributed perennial plant Plantago lanceolata that has been conducted annually since 2016. Studying global P. lanceolata populations in relation to climate change helps to inform the development of persistence models. The protocol of Plant Pop Net, an international project, was used to execute our study. Plant Pop Net aims to comprehend the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the globe. At our site in Davis. CA. we measured the abundance and phenotypic traits of P. lanceolata for five years. Data collected includes leaf length, inflorescence length, disease presence, and other phenotypic traits. We would like to investigate the influence of climate variables and disease on plant survival. Using compiled data, we will look at variation in precipitation and temperature to see if there is a correlation with yearly plant survival. In addition, yearly survival will be compared to the proportion of plants containing disease. We predict that individuals with disease will experience reduced survival compared to those without. Further, we expect higher precipitation and temperature to result in increased survival.

# Access to Emergency Contraception and Abortion Pills at California Family Planning Clinics

*Rozanne de Jesus* Sponsor: Eleanor Schwarz, M.D.,Ph.D. MED: Int Med - Genl Medicine

Pregnancy-even when desired-is a risk to a woman's health. Emergency contraception (EC) pills taken within 5 days of sex can prevent pregnancy. Levonorgestrel (Plan B<sup>™</sup>) EC pills are available throughout the United States without a prescription, but the more effective ulipristal (ella™) EC pills require a prescription. When undesired pregnancy occurs, abortion pills (mifepristone and misoprostol) can be safely used up to 11 weeks gestation. We assessed Californian family planning clinics' ability to provide EC and abortion pills to women seeking assistance by phone by performing a cross-sectional "secret shopper" survey of a 20% random sample, stratified by county, of clinics participating in California's Family Planning Access Care and Treatment program. Of the 208 clinics we contacted, 71% offered Plan B, 29% provided ella, and 12% indicated they would be able to provide abortion pills if needed. A considerable number of phone staff were not sure how to respond to women calling with a time-sensitive need for family planning services; specifically, 17%, 48%, and 34% did not know if their clinic offered Plan B, Ella, and abortion pills, respectively. Efforts remain needed to increase access to EC and abortion pills for Californian families.

Katherine De La Cruz Sponsor: Georgia Zellou, Ph.D. Linguistics

Voice assistants such as Alexa and Siri are now commonly used in the home and everyday life, yet our scientific understanding of these interactions is still in its infancy. This study tests how people of different ages (college-age adults and children, ages 7-12) talk to an Alexa device versus a human. The interactions, conducted over Zoom due to social distancing restrictions, were controlled so that participants said the same sentences to the Alexa and human interlocutors. Subjects see a list of 24 words and, on each trial, the experimenter or device asks what the next word on the list is. The subject replies with the corresponding word on their list ("The word is pig"). Then, the experimenter or device says the word back and asks the subject to repeat the sentence; on 4/24 of trials, the interlocutor mishears the pronunciation, saying a second word with a consonant error ("I heard pig or pick"). Videos are annotated in ELAN and manually checked. We predict that adults and children will show differences in the way they adjust their speech for a human versus Alexa interlocutor. Broadly, this work can reveal the impact of voice assistants on language behavior across the lifespan.

### Chlamydomonas Reinhardtii as a Sustainable Platform for Recombinant Insulin Production

Shannia Sid De Leon Sponsor: Marc Facciotti, Ph.D. Biomedical Engineering

As the demand for medicine continues to grow, current methods of therapeutic protein production can be expensive and unsustainable. Our project aims to genetically engineer Chlamydomonas reinhardtii to produce the mini-insulin recombinant protein in an effort to make medicine production sustainable and cost-effective. C. Reinhardtii is a single-celled eukaryotic algae whose chloroplast is capable of producing therapeutic-grade proteins. Because C. Reinhardtii is relatively inexpensive and only requires sunlight, low-filtration water, an inexpensive buffer, trace minerals, CO2, and a nitrogen source to survive, it is an ideal platform for inexpensive protein production compared to current methods. We report our progress towards investigating the potential of C. reinhardtii as a protein production platform, and our progress towards genetic construct design and algal strain engineering with miniproinsulin as our primary candidate protein. Currently, we are designing our protein purification protocol for when we return to the lab in person. The Algae to Insulin Project is part of BioInnovation Group, which is one of the first undergraduaterun research organizations at UC Davis providing undergraduate students with collaborative and innovative research experience.

#### Brenda De Leon Silva Sponsor: Prabhu Shankar, M.D. MED: Public Health Sciences

The ongoing COVID-19 pandemic has plagued Yolo County and Sacramento over the past year. As recommended by the Center for Disease Control, an understanding of the symptoms of the disease is necessary to take control measures and prevent spread of the infection. The majority of the mainstream information about COVID-19 symptoms only available in the English language, and families with Limited English Proficiency (LEP) are left at a disadvantage. Creating a multilingual platform can increase accuracy of symptom capture through the translation of healthydavistogether.com COVID-19 symptom tracking and important information about vaccination. The project information will be translated into the popular languages spoken in Yolo County which will be compiled both into a digital library, as well as into a pamphlet in English and other most commonly spoken languages. The symptoms will be depicted with images and checkboxes. The commonly used representations of the disease manifestations will be mapped to the currently used English terms, as well as SNOMED-CT vocabulary. If successfully implemented and maintained, this project will increase awareness, data accuracy, strengthen research, and encourage LEP population participation in COVID-19 public health preventative measures. The model could be generalizable to any future threats by illnesses to public health.

#### Olfactomedin-like 3 (OLFML3) Promotes the Glioma Cell Malignant Phenotype

*Eshetu Debebe* Sponsor: Christine Toedebusch, D.V.M.,Ph.D. VM: Surg/Rad Science

Glioblastoma multiforme (GBM), the most common adult brain tumor, is uniformly lethal. As resident brain immune cells, microglia heavily infiltrate GBM to comprise 30-50% of the tumor mass. However, instead of anti-tumor activity, microglia form a symbiosis with the tumor and facilitate its progression. While there are many contributing factors, glioma-derived TGFß1 is a key modulator of pro-tumorigenic microglia. mRNA levels of olfactomedin-like 3 (OLFML3), a novel secreted glycoprotein implicated in many cancers, is increased 9-fold increase in GBM patients. Importantly, Olfml3 is a direct target gene of ß1, with Olfml3 mRNA increasing 50-fold upon exposure to ß1. Using CRISPR/Cas9 to delete Olfml3 from a microglial cell line, we tested the hypothesis that ß1-induced microglia derived OLFML3 increases the malignant phenotype of glioma cells (GL261). We showed that treatment with rhOLFML3 increased GL261 migration and invasion. Moreover, GL261 pre-treatment with conditioned media from isogenic control microglia previously exposed to ß1 increased glioma cell migration and invasion. However, this effect was attenuated when glioma cells were treated with conditioned media from Olfml3<sup>-/-</sup> microglia exposed to ß1. Together, these data suggest that microglia derived OLFML3 contributes to the malignant phenotype of mouse glioma cells.

**Robert Dellinger** Sponsor: Rachael Bay, Ph.D. Evolution & Ecology

Coral reefs in the Anthropocene face a profound decline from a culmination of global and local threats. Genetic diversity can serve as the raw material for adaptation, buffering species from the effects of such stressors, yet large-scale surveys between and across species of coral are lacking. Therefore, it is essential to assess the drivers of genetic diversity and its consequences for recovery. Here we compile a global database of genetic diversity from microsatellites in species of Acropora, the largest coral genus. We use expected heterozygosity as a measure of diversity, and compare this to both species trait and spatial environmental data to uncover the drivers of this diversity. Preliminary analyses show that pH and species' upper depth limit are the variables most strongly associated with genetic diversity. Additionally, we find that the Caribbean Acropora palmata has unexpectedly high genetic diversity, the highest of any Acroporid species. These findings suggest that there is evidence for species-specific genetic diversity levels and that abiotic factors and anthropogenic induced stressors may influence the genetic diversity of the genus Acropora. Considering the importance of genetic diversity amongst populations, management strategies can utilize the information of allelic diversity to generate an assessment of large-scale ecological change.

### Developing a Model for Community-Driven Single-Use Plastic Reduction in Local Restaurants

Sabrina Denton Sponsor: Andrea Schreier, Ph.D. Animal Science

The presence of plastic waste in the oceans poses a major threat to marine ecosystems. Numerous marine organisms become entangled in or unintentionally ingest plastic debris, and yet, much of the population is unaware of the consequences of single-use plastics. This project aims to investigate single-use plastic consumption in local restaurants in Davis in order to develop a collaborative model that can be adapted to support and encourage restaurants to transition away from single-use plastics in Davis and other cities. This collaborative model would allow project stakeholders to use social capital to incentivize the reduction of single-use plastic in restaurants through community promotion. We will conduct research regarding conventional material costs, costs of alternatives, how current businesses incorporate compostable products, and consumer preference for sustainable materials. By investigating the cost and process of transitioning from conventional to compostable materials, we can determine the feasibility of convincing local businesses to employ this model throughout the city.

#### Balance Control Strategies During Perturbed and Unperturbed Handstands

#### Neena Deshpande Sponsor: Wilsaan Joiner, Ph.D. MED: Neurology

The central nervous system uses distinct strategies involving the ankle and hip joints to compensate for altered sensory conditions while standing and maintaining balance. In handstand balancing, since the body is inverted, these strategies correspond to the wrist and elbow joints. Recent studies have shown that visual perturbations alter the balancing strategies to increase the proportion of time spent balancing using the elbow joint. In this preliminary study, we examined the influence of visual and physical perturbations on handstand balancing by using balancing blocks to change the position of the hand: rather than placing the hands flat on the floor, the hands gripped the blocks with fingers curled. We examined a trained gymnast performing handstands on the floor and with the blocks, with the eyes either open or closed. We found that the balancing strategies during the control condition (handstand on the floor with eyes open) significantly changed with the visual and physical perturbations. Simultaneous perturbations had a somewhat additive effect on the use of the elbow strategy. Together, our preliminary results suggest that visual (via the eyes closed) and physical perturbations (via changing the hand position) differentially affect the strategies used by the central nervous system to maintain balance.

### Optimization of Armillaria mellea Growth Media

Janessa Destremps Sponsor: Patrick james Brown, Ph.D. Plant Sciences

The fungus Armillaria mellea is a known causal agent of Armillaria Root Rot (ARR) which affects many agronomically important crops such as walnuts. One of the most common rootstock varieties used for walnuts, Paradox, is susceptible to ARR. ARR is a difficult disease to control and leads to reductions in crop yields and growth. The goal of this project is to develop and optimize a soil-based screening assay for A. mellea resistance that can be performed rapidly using small clonal walnut rootstock plants. Cultured A. mellea was grown in different conditions to measure its virulence and growth. These conditions included varying percentages of soil (sunshine #4) and Paradox wood chips from the Paradox rootstock. Three months post inoculation, cultures with higher percentages of Paradox wood chips than sunshine #4 showed better growth. A mix of 50% Paradox wood chips and 50% sunshine #4 was the least amount of Paradox wood chips that still supported mycorrhizae and rhizomorph growth. Additionally, A. mellea grew best in autoclaved media free from other microbes as it is susceptible to competition. Based on these findings, the virulence of A. mellea depends on the media it is grown in as well as the surrounding competition.

Janessa Destremps Sponsor: Diane Beckles, Ph.D. Plant Sciences

Tomatoes are universally popular, high in fiber and antioxidants, and are revered for the 'authenticity' they add to many cultural dishes. However, consumers have expressed unhappiness with the quality of store-bought tomatoes, because trades-offs made with respect to enhancing shelf-life and optimizing quality. To prolong shelf-life, tomatoes may be harvested before they reach full ripe and stored for variable periods before consumption, conditions that destroy fruit quality compared to fruit harvested when ripe. The genes that are affected by different postharvest storage conditions have not been fully characterized, but a better understanding of their mode of action may help to improve tomato quality. Transcriptomics and methylomics were used to identify genes whose expression changed in concert with changes in tomato fruit quality due to different postharvest handling. Several differentially expressed genes were identified, many of which have not been previously implicated in tomato fruit quality. In this work, we initiated a bioinformatic analysis of these genes and their cognate gene families, in tomato and other species, to determine if they are universally involved in fruit quality or ripening. This is the first step towards their functional analysis in fruit, using reverse genetics approaches, and long-term improvement in commercial fruit quality.

# The Palm Oil Dilemma and Rethinking Carbon Neutrality Calculations

Jenna Deutschman Sponsor: Sue Vang, M.S. CP: Environmental Stewardship

Palm oil is the most widely used oil and a highly fungible resource found in common products. However, palm oil production requires a tropical rainforest climate and is thus a driver of deforestation and peatland destruction. To understand the scope of the problem, palm properties, economic drivers, and various emission measurement methods were assessed. To find a feasible alternative to palm oil, other oil sources were compared against palm oil based on climate zone, global warming potential, crop yield, soil toxicology, and deforestation history. When evaluated against the criteria, palm oil proved to be the most overall environmentally damaging oil. Despite the problems palm oil presents, there exists no effective market regulation; the current leading "sustainable" palm oil certification programs are demonstrated to be unreliable. Palm oil demand must not increase to stop rapid peatland destruction and deforestation. Because of the global palm oil dependency and lack of effective sustainable certification programs, both government and consumer action are necessary to control deforestation and peatland destruction. The results challenge sustainability certification programs, emission measurement methods, and the scope for carbon neutrality.
## The Correlation Between B1 cells and Primary Biliary Cholangitis

## Harleen Dhillon Sponsor: Weici Zhang, M.D.,Ph.D. MED: Int Med Rheumatology

Primary biliary cholangitis (PBC) is an autoimmune liver disease characterized by the immune-mediated inflammatory destruction of small bile ducts. However, the underlying mechanisms of PBC are largely unknown. Since the presence of hyper-IgM is one of the characteristic features of PBC, we aim to investigate what drives hyper-IgM production and whether hyper-IgM exerts a pathogenic role in PBC. To do so, we took advantage of a murine model to study B1 cells from the peritoneal cavity, since B1 cells are the main resource for IgM antibodies. We specifically used models with AU-Rich Element deletion, which results in chronic elevated interferon-gamma levels and hyper-IgM levels. We measured IgM levels in the serum and extracted B1 cells from the peritoneal cavities. We then stained peritoneal cavity cells with the antibodies against cell surface markers CD5, CD11b, IgM, and B220 to identify B1 and IgM-expressing populations in each model. Our results showed that there were significant increases in B1 cells and IgM-expressing cells in the PBC model vs. the wild type control. Based on these significant findings, we will be able to further investigate the pathogenesis of primary biliary cholangitis in relation to hyper-IgM levels.

## Warmth, Competence, and Social-class of Immigrants

## Sheyla Mirka Dirzo Sponsor: Jeffrey Sherman, Ph.D. Psychology

The Stereotype Content Model (Fiske, Cuddy, Glick, & Xu, 2002) argues that competence and warmth are the critical components of social stereotypes, and people view immigrants as low-competence and low-warmth. However, a growing literature argues that stereotypes about immigrants are intersectional - depending on the origin country, race, and socioeconomic status (Lee & Fiske, 2006; Martinez, Feldman, Feldman, & Cikara, 2021). In the current work, we examined how stereotypes about warmth/competence and socioeconomic status depend on an immigrant's origin country. The stimuli in the task were previously constructed faces of immigrants and U.S. citizens of various ethnicities and countries of birth created by UC Davis students(Hutchings et al., in prep). UC Davis students will rate the competence, warmth, educationlevel, and wealth of Canadian, Chinese, and Mexican immigrant and U.S. citizen faces. We predicted that the faces of immigrants appeared more threatening and less trustworthy compared to those of U.S citizenship. This work has importantimplications for shifting the perspective on stereotypes given most stereotype formation/bias is focused on outdated stereotypes.

Raymond Doan Sponsor: Gail Bornhorst, Ph.D. Biological & Ag Engineering

Food buffering capacity influences intragastric pH during digestion, which can affect food breakdown, acid secretion, and may have health implications. The objective of this study was to characterize the buffering capacity of two model foods with macronutrient composition based on the Standard American Diet. Model foods were prepared as aqueous dispersions and solidified using thermal gelation. A strong and weak version of the model food were prepared by modulating dispersion pH. Buffering capacity was measured on dispersions (before gelation). large cubes (1.3 cm), and small cubes (0.65 cm) after gelation. Buffering capacity was measured by taking the pH of 20 g sample while adding 0.5 mL aliquots of 0.16 M HCl until an endpoint pH of 1.5 was reached. Experiments were completed in triplicate. Total buffering capacity was not significantly influenced by type of model food (p>0.05), but was significantly influenced by model food physical form (p<0.05). The weak gel in dispersion form had the highest total buffering capacity (106

 $\mu$ mol H<sup>+</sup> per (g sample × total pH change)). The physical form of a model food (large cubes, small cubes, or dispersion) influenced total buffering capacity. This information could help future researchers design functional foods for improved human health.

## Legal Consciousness Among Legal Aid Workers: A Narrative Analysis

**Rachel Drizin** Sponsor: Timm Grattet, Ph.D. Sociology

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

#### Does the Nature of Rotation Matter? Assessing Infants' Mental Rotation in an Online Task.

Anthony Easter III Sponsor: Lisa Oakes, Ph.D. Psychology

Mental rotation, which is the ability to mentally manipulate and make predictions about an object's orientation, is critical for understanding objects in our daily lives. Previous studies have revealed sex differences during infancy, specifically that boys show greater mental rotation than girls (Moore & Johnson, 2008; Quinn & Liben, 2008, Lauer et al., 2015). The goal of the current study was to assess how the nature of the rotation influences infants' mental rotation. We tested infants using an online platform called Lookit (Lookit.mit.edu) that allows families to participate in studies from home. One-hundred-fifty infants between the ages of 6 and 13 months were tested in a modified version of the task used by Lauer et al. In that task, infants were shown two stimulus streams containing identical tetris-shaped items that repeatedly appear and disappear. On every third presentation one stream contained the mirror image of the item in the other stream. We manipulated the nature of rotation by presenting some trials in which the items rotated sequentially (i.e., continuously and clockwise); the remaining trials were nonsequential and random. Ongoing analyses will allow us to evaluate previously observed patterns in mental rotation tasks, including age and sex-related differences.

## Numerical Simulation of Nitrogen-Vacancy Center Quantum Spin Dynamics Using QuTIP

Sarah Edwards Sponsor: Nicholas Curro, Ph.D. Physics

Nitrogen-vacancy (NV) centers, defects in diamond lattices whose quantum properties can be manipulated using an external magnetic field, are popular in solid-state magnetometry and quantum information for their high sensitivity and long coherence times. Typically, NV centers are treated experimentally as two-level systems, considering only the spin = 0 and spin = +1 or -1 cases. However, the full spin-1 multiplet can be exploited to increase sensitivity in AC magnetometry by taking into consideration all three possible orientations of the NV electronic spin, a method referred to as double-quantum coherence. This can be difficult, as existing computational methods for numerically solving differential equations often fail to accurately represent mixed quantum states. This project explores various numerical methods for computing these mixed states for magnetic pulse sequences in AC magnetometry via double-quantum coherence using QuTip (qutip.org), a quantum computing package for Python, with the aim of developing techniques to efficiently model double-quantum coherence in NV centers.

Benjamin Elliott Sponsor: J German, Ph.D. Food Science & Technology

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

## Canonizing the Uncanny: The Power of Spiral Sight in Patricia Grace's *Potiki*

*Eli Elster* Sponsor: Tobias Menely, Ph.D. English

Multiple scholars have noted the "spiral temporality" used by Patricia Grace in her 1986 novel Potiki, which treats the past, present and future as simultaneous and uniformly accessibleyet no one has connected spiral time to the uncanny, an equally present and urgent phenomena in the novel. In this paper, I examine how the uncanny works upon both the colonizers (land developers) and colonized (a small Maori community, named the Tamihanas); how, for either side, it relates to a certain understanding of time; and how spiral time manifests, for the Tamihanas, as a "spiral sight," which allows them, namely, to canonize the uncanny. My main example concerns the Tamihanas's battle with the developers over their land, as both sides react to their nemeses with a mix of uncanny fear and dissociative agnosia. Their reactions fit within a tropological framework described by Alan Lawson, who also clarifies and calls for, in his work, a version of spiral sight. Additionally, I propose a broader category, termed here a "practical temporality," within which to place modes of praxis that stem from non-Cartesian temporalities.

#### Assessing Behavioral Changes in Offspring Raised in a Single-Parent Environment Using the Rock Dove as a Model Organism

#### Daniel Erenstein

Sponsor: Rebecca Calisi, Ph.D. Neuro Physio & Behavior

Nearly one-quarter of children in the United States live in a single-parent household, the highest rate of any country in the world. Previous research about single-parent households has found that children with single parents experience changes to the amygdala-the brain region controlling fear and stress behaviors-that often result in anxiety, depression, and withdrawal, outcomes that can be reflected in adulthood. However, the underlying molecular and cellular changes to the amygdala are not fully understood. This study aims to examine amygdala changes in single-parent offspring at the cellular, molecular, and behavioral levels using the rock dove (Columba livia) as a model organism. First, we will assess behavioral changes in squabs at day 5 post-hatch and then characterize molecular changes to the amygdala. Twelve-hour video recordings are scored using the BORIS system for coding standardized measurements of squab behavior, including head waggle and bill searching. Based on previous studies, we expect to see an increase in anxiety-like behaviors of squabs from single-parent environments compared to those from dualparent environments. Overall, our research contributes to an understanding of the impacts of single parenting on children, specifically contributions of the amygdala—the brain's emotional center-to behavioral changes in humans.

# Redesigning the Prosthetic Leg: a Design for a Healthier Lifestyle.

Janet Escobar-Hernandez Sponsor: Jonathon Schofield, Ph.D. Mechanical & Aerospace Engr

As technology becomes more advanced, the quality of prosthetics increase, decreasing affordability and depriving many of access to these devices. With an increase in the need for innovation and cost-effective prostheses, our team is set on designing a higher performance prosthetic using sustainable and affordable materials. Working with a leg amputee directly, our below-the-knee prosthetic leg prioritizes comfort and adaptability for an active lifestyle. Our design is divided into 3 main parts being the pylon, socket, and foot. We conducted a concept screening to define the core concepts within each part. These include a vertically rotating ankle, self-molding socket interior, and a shape that allows for full range of motion at the knee. We are currently developing the pylon and the foot of our design by conducting extensive material and biomechanics research to achieve optimal performance during the Gait cycle while walking and jogging, turning, and even going up and down stairs. Throughout the process we will validate and verify our design to ensure the client's needs are properly assessed. Once we establish a working design, we will create a CAD model and proceed with the testing and prototyping phases.

Savannah Espinola Sponsor: Lisa Oakes, Ph.D. Psychology

From birth, infants preferentially look to the faces in their environment. Across the first year of life, infants prioritize different regions of the face (e.g., the eyes or mouth) as various visual cues become more or less relevant. For example, as infants learn language, they may prioritize their attention to the mouth of a speaker (Lewkowicz & Hansen-Tift, 2012). As a result of the COVID-19 pandemic, face masks have become a part of daily life for many Americans, raising the question: will face masks affect our ability to recognize one another? Studies investigating this question have found that adults are impaired at both learning and recognizing faces with masks (Carragher & Hancock, 2020). Given the importance of faces for infants' learning, we tested whether infants would show differential learning and recognition patterns to masked and unmasked faces. Additionally, we asked parents to report on their infant's experience seeing people wear face masks. To date, we have tested approximately 50 infants aged 4- to 12-months online and are currently analyzing this data to present in the Spring. This work will contribute to our understanding of how various aspects of facial input are related to infants' learning across the first year of life.

## Making Fishtory: Observing Juvenile Salmon Growth Through Archival Tissue.

*Kimberly Evans* Sponsor: Rachel Johnson, Ph.D. John Muir Institute-environ

California Central Valley (CCV) Chinook Salmon are born in freshwater, eventually enduring a vulnerable migration to the ocean to carry out the majority of their lives before returning to freshwater to spawn. The life transition for juveniles between freshwater and the ocean creates the following question: where are the most viable environments for preparing juvenile Chinook Salmon for this outmigration? Different habitats provide diverse environmental conditions, leading to differential growth opportunities for salmon. We investigate how regions of the Sacramento Sutter Bypass in 2019 impacted the growth of CCV Chinook Salmon prior to completing their departure from freshwater into the ocean. We hypothesized that salmon rearing in the Sutter Bypass would have increased growth rates due to the less competitive environment, greater abundance of food, and decreased predation. To test for growth variation in different habitats, I utilized a common metric for observing fish growth through analyzing the width of daily growth bands recorded in archival tissues called otoliths. This method helped to determine how fast the Sutter Bypass salmon grew while in experimental enclosures and captured in the wild in comparison to other locations. Through this research, conservationists are better able to target key habitats for this native species.

### Exploring the Relation between Contextual Attention and Theory of Mind in Children

## Kate Everhardt Sponsor: Lindsay Bowman, Ph.D. Psychology

Theory of Mind (ToM) describes the understanding that internal mental states, such as desires, beliefs and thoughts, guide external behavior in the real world. ToM is foundational to functioning in the social world, including teaching, moral judgements and cooperation. This understanding develops dramatically from ages 3- to 8-years, but more research is needed to uncover all of the contributing factors (e.g., language development) that support the transition to a mature understanding of others' mental states. This project will examine a theoretically important but underexplored contributor to children's ToM: the ability to attend to contextual information in a scene, and to use that information to inform judgements about a character's mental state. Prior research has shown reliable individual differences in children's context sensitivity that are independent of other non-social skills (e.g., executive function). The present study examines children's attention to contextual information in both social and non-social scenes, and how individual differences in these skills relate to ToM in children ages 4- to 8-years-old. The research study is ongoing, data collection will be done through an online platform, and results and analyses will be completed by spring of 2021.

## A Population-Based Modeling Approach to Investigate the Mechanisms Regulating Vascular Smooth Muscle Cell Electrophysiology in Health and Disease

Brianna Nicole Fabian Sponsor: Stefano Morotti, Ph.D. MED: Pharmacology

Vascular tone, the main determinant of blood pressure regulation, is controlled by the coordinated contraction and relaxation of vascular smooth muscle cells (SMCs). Since regulation of SMC contractile state is impaired in diseased conditions like hypertension (HT) and diabetes, therapeutic treatment requires better characterization of the subcellular mechanisms controlling SMC electrophysiology. Here, we aim to investigate differences in the response to vasoconstrictor and vasodilator stimuli in control and HT SMCs. We randomly modified the parameters of an established mathematical model of rat mesenteric SMCs to create two populations of control and HT cells. We simulated norepinephrine (NE) and nitric oxide (NO) administration, and assessed the changes in membrane potential and cytosolic Ca concentration in each model of the two populations. We performed linear regression analysis on the population data to determine the role of ion channels and transporters in the control of SMC electrophysiology before and after NE/NO stimulation. Completion of this study will allow the characterization of variability in populations of SMCs, and the identification of the key mechanisms that could be targeted therapeutically to restore SMC function in HT.

## Pilot Study comparing blood and urine concentrations and pharmacokinetics of Flunixin Meglumine oral, injectable and transdermal in donkeys (*Equus asinus*)

*Tara Falt* Sponsor: Amy Mclean, Ph.D. Animal Science

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

## Vision for the agricultural system in 2050

*Yuting Fan* Sponsor: J German, Ph.D. Food Science & Technology

The current agriculture and food system is devastating the environment and damaging people's health. The massive amount of resources required for agricultural production is impacting the entire world. A significant proportion of food products are wasted at every step along the way from production to consumption. A central problem weaving its way through all of agriculture, linking inefficiency, waste and even health is the perishability of foods. If the problem of food instability were solved, harvesting, transportation, processing and health can take advantage of multiple innovative technologies of the modern world. The problems existing in the current food system can be addressed by a single concept-processing. Instead of public perception of processing as an evil invention, innovative processing can be the key to safely stabilizing perishable food products. After foods are made stable, it will be possible to incorporate the global food system into modern computational models of supply, inventory control, byproduct recovery and precision health. The immediate benefits will be to accurately deliver foods according to personal needs using everything from autonomous delivery to handheld devices. By 2050, such a food system would improve the environment, capture waste and nourish the most healthy, active and joyous generation in human history.

### Development of a Low-Cost and Reliable Reaction Wheel for CubeSat Attitude Control

Forrest Fankhauser Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

This presentation discusses the development of a low-cost Manufactured Reaction Wheel (MRW) system for the REALOP mission, UC Davis's first and completely undergraduate-led CubeSat mission. Commercial reaction wheel systems typically exceed budgets for university missions, so the motor and reaction wheels are independently acquired and joined with a thermal-press fit to ensure cost-effectiveness and reliability. Once in orbit, the MRW will autonomously stabilize and precisely orient the CubeSat so that the satellite's visible light and infrared cameras can take clear photos. The MRW control systems team is developing a methodology to find a PID controller which meets the mission requirements. This process begins with finding a model of the system, applying and tuning the controller, then verifying results with physical testing. A general approach allows for testing on low-cost motors, in preparation for quick and safe tuning of the assembled MRW. Many university CubeSat missions are hindered by the expense of reaction wheel systems; successful use and thorough documentation of REALOP's Manufactured Reaction Wheel system will provide future missions with easier access to lowcost, reliable reaction wheel systems.

## Structural Racism in Scientific Literature

Yasameen Farahvash Sponsor: John Furlow, Ph.D. Neuro Physio & Behavior

The ways in which we describe scientific data and results in research articles often lack racial inclusivity and sensitivity. For example, using the white race as the reference group in multivariable analyses normalizes the white experience as the standard experience, thereby implicitly acknowledging the existence of racial hierarchies. In this project, we investigated how structural racism pervades the scientific literature by examining the use of the white race as the reference group in observational public health studies in the United States. Our initial search identified 1.849 articles, of which we reviewed the top 300 based on relevancy. After screening for specific inclusion criteria. 88 articles were retained for full data extraction. Of these, 83 used "white" as the reference group; however, not all had "white" as the largest demographic group, a common rationale for determining the reference group. The scientific literature includes widespread use of the white race as the standard to which all other race and ethnicity outcomes are compared. Future efforts must support the elimination of the white-centric frame of thinking that negatively influences scientific research and undermines important outcomes at the intersection of race and public health.

## An Affinity-Tagged Allele of the Breast Cancer Associated Gene *BRCA2* to Investigate Meiotic Recombination in Mice

#### *Claire Fargeix* Sponsor: Neil Hunter, Ph.D. Microbiology & Molec Genetics

Meiosis is the process by which haploid eggs and sperm are produced from diploid germ cells. The chromosome repair process called homologous recombination is essential for meiosis and more generally for enhancing genetic diversity and enhancing genomic integrity. Breast Cancer Associated Gene 2, or BRCA2, encodes a protein that mediates proper homologous recombination. Mistakes in meiotic recombination can result in infertility, miscarriage, and congenital disease, so it is vital that we understand how this process works and how it can go wrong. To study BRCA2 function in meiosis, we created a hemagglutinin (HA) tagged version of the mouse gene, BRCA2-3HA, using the CRISPR-Cas9 gene-editing technique. In order to confirm that the tag does not affect the function of the essential BRCA2 protein, and thereby the fitness of the mice, I examined the number and size of the litters born to females with and without BRCA2-3HA. I also analyzed the chromosomal localization of several proteins, RAD51, DMC1, RPA, and MLH1 specifically, involved in recombination during meiosis. Showing that the BRCA2-3HA allele is fully functional in mouse will eliminate any ambiguity regarding results obtained using BRCA2-3HA mice and our findings using this novel tool.

## Identifying Breed Differences in Abnormal Repetitive Behaviors of Dairy Heifers: Effects of Feed-Related Stress on Non-Nutritive Oral Manipulation

Ashley Felsch Sponsor: Cassandra Tucker, Ph.D. Animal Science

Dairy cattle are motivated to consume forage and perform oral abnormal repetitive behaviors when feed is restricted in farm settings. Common dairy breeds. Jerseys and Holsteins, differ in time spent foraging in their natural environment. If abnormal behaviors serve as a way to replicate frustrated natural foraging behaviors, then these breeds should differ in their response to feed restriction. Our objective is to assess whether Jersey and Holstein heifers differ in time performing oral abnormal repetitive behaviors in response to precision feeding, a common practice in commercial dairies that restricts time spent eating. Thirty-three Holstein and nine Jersey heifers were limited to 50% of their previous food intake for two days. On the second day of restriction, all heifers were recorded for 24 hours to measure the time engaged in abnormal behaviors. We hypothesize that Jerseys will experience more frustration in response to limited feeding time, as they naturally spend more time feeding than Holsteins. We expect they will spend significantly more time performing oral abnormal repetitive behaviors, including tongue rolling, tongue play, and nonnutritive oral manipulation of pen structures and bedding, than Holstein heifers.

## Priscilla Ferreira Servin Sponsor: Katharine Graf Estes, Ph.D. Psychology

Caregivers play a crucial role in infants' language experience. Infant-directed speech (IDS) includes features like slow speech rate, higher pitch, and word repetition than adult-directed speech (ADS). It's believed that this speech register facilitates language learning. However these features are from monolingual studies. We know very little about bilingual IDS. The IDS literature suggests that diminutive words (i.e., kitty) is another feature frequently used by parents talking to their infants. Diminutives may facilitate lexical learning because they regulate the prosodic shape of words, helping infants segment and learn words in their languages. The purpose of this study is to explore diminutives with Spanish-English bilingual parents and English-speaking parents. Eight-to-20-month-olds and their parents (N = 40) participated in a set of interactive tasks containing objects labelled with target words in English (for monolinguals) or English and Spanish (for bilinguals). From coded transcripts of the sessions, we will analyze the frequency of diminutives use by parents. We predict bilingual parents will use more diminutives than monolingual parents because it is common in Spanish for IDS nouns to be diminutivized. We will test whether bilingual parents produce more diminutives in English than monolingual English-speaking parents, suggesting an influence of the bilinguals' Spanish knowledge.

## Reimagining Counseling Services and the Power of Traditional Healing for Undocumented Immigrants

Ofelia Ferreyra Ruiz Sponsor: Susy Zepeda, Ph.D. Chicano Studies

Through my initial research, it has come to my attention that underserved communities, such as undocumented immigrants, are very resistant to counseling services. I argue that they are unable to connect with the Western ideologies that are utilized in counseling services. Reason being, undocumented immigrants seek out their culture's traditional healing practices and affirmations for a body, mind, and spirit holistic approach. In my research, I focus on the innovative possibility of integrating traditional healing practices into counseling services as a pathway to provide the most effective and sustaining care to the undocumented community. To explore this possibility, I will be virtually interviewing six UC Davis undocumented students to learn about their experiences with mental health services and culturally relevant traditional healing practices. I will also be interviewing four on-campus counselors at UC Davis to inquire about their practices. I expect my research findings will yield knowledge on how we can reimagine counseling services into a dynamic system that is accessible, inclusive, and transformative for the undocumented community.

#### *Tomer Fidelman* Sponsor: Giovanni Peri, Ph.D. Economics

While there has been a growing literature regarding the impact of different forms of economic downturn on the aggregate measures of nations, there has been little evidenced based research regarding the direct effect on income groups of these countries. This paper examines the implications of economic downturn, focusing on specific types of asset price bubbles, on varying income shares across 17 advanced economies, centering on years 1945 and onward. Obtained results from local projections models indicate that the top and bottom income groups respond uniquely to different asset price bubbles, and recover in patterns that challenge current consensus. By comparing findings across nations of varying inequality, as well as time periods of differing inequality, the models utilized identify consistent response trends in the aftermath of asset price bubbles. Lastly, the analysis offers a nuanced view of what high income inequality growth can mean for nations experiencing various asset price bubbles.

# The development of social attention in infants at risk for autism and ADHD

#### Nat Finnegan

Sponsor: Meghan Miller, Ph.D. MED: Psychiatry & Behav Sci

(ASD) Autism spectrum disorder and attentiondeficit/hyperactivity disorder (ADHD) likely share genetic traits, and studies have implicated atypical patterns of attention in both syndromes. However, no study has yet examined attentional differences between infants developing high ASD symptoms, high ADHD symptoms, and low symptoms. We examined group differences in early looking patterns at 12, 18, and 24 months of age during an eye-tracking task of social preference among infants at familial risk for ASD (n=48), familial risk for ADHD (n=36), or low-risk for both (n=35). At 24 months, the children were classified into outcome groups reflecting high ASD symptoms (n=28), high ADHD symptoms (n=23), or low symptoms (n=46). The social preference task consisted of two paired video clips: One displaying social stimuli and the other displaving non-social stimuli. At 12 months of age, the high ASD-symptom group looked significantly more at the social target than the other two groups. From 12-36 months, the high-ASD symptom group demonstrated declining trajectories of time spent looking at social stimuli, while the low symptom group significantly increased looking times to social stimuli; the high-ADHD symptom group showed a trend toward increasing social looking times. The mechanisms underlying attentional processes in ADHD and ASD may differ.

## Samuel Flohr Sponsor: Jennifer Gremer, Ph.D. Evolution & Ecology

This project is a continuation of a study on the globallydistributed perennial plant Plantago lanceolata that has been conducted annually since 2016. Studying global P. lanceolata populations in relation to climate change helps to inform the development of persistence models. The protocol of Plant Pop Net, an international project, was used to execute our study. Plant Pop Net aims to comprehend the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the globe. At our site in Davis. CA, we measured the abundance and phenotypic traits of P. lanceolata for five years. Data collected includes leaf length, inflorescence length, disease presence, and other phenotypic traits. We would like to investigate the influence of climate variables and disease on plant survival. Using compiled data, we will look at variation in precipitation and temperature to see if there is a correlation with yearly plant survival. In addition, yearly survival will be compared to the proportion of plants containing disease. We predict that individuals with disease will experience reduced survival compared to those without. Further, we expect higher precipitation and temperature to result in increased survival.

# Assessing Drivers of Genetic Diversity On Coral Reefs

John Amiel Flores Sponsor: Rachael Bay, Ph.D. Evolution & Ecology

Coral reefs in the Anthropocene face a profound decline from a culmination of global and local threats. Genetic diversity can serve as the raw material for adaptation, buffering species from the effects of such stressors, yet large-scale surveys between and across species of coral are lacking. Therefore, it is essential to assess the drivers of genetic diversity and its consequences for recovery. Here we compile a global database of genetic diversity from microsatellites in species of Acropora, the largest coral genus. We use expected heterozygosity as a measure of diversity, and compare this to both species trait and spatial environmental data to uncover the drivers of this diversity. Preliminary analyses show that pH and species' upper depth limit are the variables most strongly associated with genetic diversity. Additionally, we find that the Caribbean Acropora palmata has unexpectedly high genetic diversity, the highest of any Acroporid species. These findings suggest that there is evidence for species-specific genetic diversity levels and that abiotic factors and anthropogenic induced stressors may influence the genetic diversity of the genus Acropora. Considering the importance of genetic diversity amongst populations, management strategies can utilize the information of allelic diversity to generate an assessment of large-scale ecological change.

*Kailey Flynn* Sponsor: Susan Pike, Ph.D. Inst Of Transportation Studies

Public health concerns caused by COVID-19 throughout 2020 left transit agencies facing challenges such as declining ridership and increased costs. Though this pandemic has altered daily operations, there have also been increased opportunities to implement technologies or policies such as contactless payments or mobile ticketing. The aim of this study is to understand the impact COVID-19 has had on the factors that impact agencies' pursuit of these types of innovations. This study uses survey data collected from transit agencies across the United States. Respondents were asked about their pursuit of fare free service, contactless payment, on demand services, mobile phone based ticketing, and shared-use mobility partnerships. The survey also asked background questions about the transit agencies, such as fleet size, sources of funding, and geography (i.e. rural and urban). Our results so far suggest that COVID-19 changed how agencies view these different innovations and that policy entrepreneurs have played a large role in influencing their progress. We will also examine how fleet size and geography, as well as attitudes towards these innovations impacted their implementation during the pandemic.

# Initial Attraction and Post-Pairing Affiliation in Titi Monkeys: A Preliminary Assessment

*Weng Ian Fok* Sponsor: Karen Bales, Ph.D. Psychology

In humans and other monogamous species, the development of pair bonds follows a typical course of initiation, formation, and maintenance. Although pair bonding has been studied in many species, there is little research on mate choice in monogamous non-human primate. We investigated initial attraction and pair bond outcomes in socially monogamous titi monkeys (Plecturocebus cupreus), an established model of human pair bonding. Our goals were (1) to identify the behavioral characteristics of initial attraction in titi monkeys and (2) to explore the relationship between initial attraction and relationship trajectories post-pairing. We hypothesized that initial attraction would predict affiliative behaviors after bonding. Subjects were 6 sexually-naïve titi monkeys (3 males, 3 females). Initial attraction was determined from a series of round-robin "speed dating" experiments, in which each monkey interacted with each potential mate for 30 minutes. The behaviors scored included proximity to the potential mate and vocalizations. Based on proximity, monkeys were paired with their most attracted partner. We present preliminary results investigating whether vocalizations and proximity to the potential mate are correlated, and whether these behaviors predict affiliation with the partner they were paired with. These results will provide evolutionary insights on the origins of relationship formation in humans.

## Replication-Stress Induced Nucleophagy Suppresses Chromosome Damage During Mitosis

## Lauren Ford Sponsor: Kenneth Kaplan, Ph.D. Molecular & Cellular Bio

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

# Derivation and Analysis of Time Dilation and Gravitational Redshifts of Star S0-2 Near the Galactic Central Supermassive Black Hole

Tanya Freshour Sponsor: David Wittman, Ph.D. Physics

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

## Repeated Exposure of Mozambique Tilapia (Oreochromis mossambicus) to Salinity Increase for Analysis of Histone Post-translational Modifications

#### Yuhan Fu Sponsor: Dietmar Kueltz, Ph.D. Animal Science

Mozambique tilapia (Oreochromis mossambicus) is a euryhaline species with the capacity to tolerate an exceptionally large range of salinity. In this study, we test if the epigenetic response of fish to salinity stress depends on previous exposure to the same stress. Our experimental design includes 24 tilapia in 3 groups that are exposed to 85 g/kg seawater for 0, 1, and 3 times respectively. Handling controls are included in the experimental design. We will increase salinity by 7.5 g/kg per day until 85 g/kg, then decrease to 0 g/kg, and repeat. Using the web camera, we will observe behaviors of fish and monitor whether salinity changes alter behavior. We will also measure hepatosomatic and gonadosomatic index of fish and compare their weights and lengths after repeated exposure. We expect that all tilapia will survive with no mortality as 85 g/kg has been previously demonstrated to be well below their upper tolerance limit of 120 g/kg. Moreover, we hypothesize that histone PTM stoichiometry will depend on the number of exposures to salinity stress. Our experiment paves the way for future characterization of the dynamics of osmoregulated histone PTMs in Mozambique tilapia.

# The QAnon Conspiracy Theory and Spiritual Warfare in Contemporary Christianity

Stephen Fujimoto Sponsor: Allison Coudert, Ph.D. Religious Studies

During the Donald Trump presidency, many of the president's supporters latched onto and disseminated the QAnon conspiracy theory which centers around a prophecy that President Trump will take down a satanic pedophile ring of Democrat politicians and liberal elites. Along with helping to inspire offline violence like the insurrection at the United States Capitol in January 2021, the conspiracy theory has attracted a "big tent" of various groups, including conservative Christians. I seek to answer why they would be attracted by presenting a case study of a QAnon-promoting Christian group, Omega Kingdom Ministry (OKM), using public recordings of weekly meetings uploaded online by the ministry. A particular focus will be placed on their teachings and practices around spiritual warfare, many inspired by the larger New Apostolic Reformation movement. These beliefs will also be traced back historically to America's infancy when the Purtian desire to be a moral example to the rest of the world was incorporated to the cultural fabric of this nation. Ultimately, I argue that OKM's views on spiritual warfare, a product of larger contemporary and historical movement, are very compatible with the QAnon conspiracy theory, explaining why the group spreads both QAnon and Christian beliefs simultaneously.

## Brenna Gallagher Sponsor: Brenna Henn, Ph.D. Anthropology

Recent studies have shown inbreeding depression for height in European populations where a decrease in height is correlated to an increase in homozygosity, expressed as FROH. We attempt to identify this correlation within the Himba population who exhibit increased levels of inbreeding. The Himba are an endogamous Namibian pastoralist population that regularly engage in fostering familial kin as a form of cooperative breeding. To investigate the relationship between FROH and height in this population, we use genotype, height and other demographic data from 309 adult Himba individuals. We identify runs of homozygosity (ROH) at 1500 KB threshold from which FROH is calculated. Log-log linear regression models are created to predict height from FROH with covariates of sex, age and fosterage. Fosterage was included based on the findings of Scelza and Prall (2014), who found reduced height to be associated with fostered individuals. Contrary to previous findings, we did not find a significant effect of FROH on height in the Himba population, regardless of the inclusion of fosterage as a covariate. A relationship between height and FROH may have been undetectable due to our limited sample size, or another environmental factor not accounted for.

## Development of a Reliable, Low-Cost Reaction Wheel for CubeSat Attitude Control

*Timothee Galmiche* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

This presentation discusses the development of a low-cost Manufactured Reaction Wheel (MRW) system for the REALOP mission, UC Davis's first and completely undergraduate-led CubeSat mission. Commercial reaction wheel systems typically exceed budgets for university missions, so the motor and reaction wheels are independently acquired and joined with a thermal-press fit to ensure cost-effectiveness and reliability. Once in orbit, the MRW will autonomously stabilize and precisely orient the CubeSat so that the satellite's visible light and infrared cameras can take clear photos. The MRW control systems team is developing a methodology to find a PID controller which meets the mission requirements. This process begins with finding a model of the system, applying and tuning the controller, then verifying results with physical testing. A general approach allows for testing on low-cost motors, in preparation for quick and safe tuning of the assembled MRW. Many university CubeSat missions are hindered by the expense of reaction wheel systems; successful use and thorough documentation of REALOP's Manufactured Reaction Wheel system will provide future missions with easier access to lowcost, reliable reaction wheel systems.

## Gabriela Ganoza Sponsor: Lisa Oakes, Ph.D. Psychology

Infants are incredibly adept learners, possessing the ability to gather pertinent environmental information about the world and how it works. This study investigates the relationship between an infant's access to information, in the form of motor development, and their visual attention to objects with complex features. Research has shown a robust link between infant experience manipulating objects and their visual attention to object properties. In the present study, 4-12-month-old infants (N = 100) were shown pairs of unfamiliar objects. One object was easily "graspable", with a handle-like region, specialized for grasping, while the other was not. Additionally, parents completed a motor development questionnaire about their infant's motor abilities. All data were collected through the Lookit online platform and coded with Datavyu software for the duration of looking at both objects. We hypothesize that increasingly complex motor capabilities, such as crawling or walking will influence the features of objects that infants find most interesting. Thus, an infant with motor ability that allows for object obtainment and manipulation will show a visual preference for objects with specialized features, such as handles.

## Influence of Striga Infestation on Microbial Communities Colonizing Sorghum Roots

Adrian Garcia Sponsor: Siobhan Brady, Ph.D. Plant Biology

Sorghum is a key economic and nutritional cereal crop in Africa, but its production is currently threatened by the parasitic plant, Striga hermontica. Currently available methods to control the parasite, are either not available for smallholder farmers, not easily integrated into agricultural practices and have low efficiency. A microbiome-based solution can be an affordable and easy alterative way to reduce Striga infection. Producing an effective microbial product, requires a better understanding of how Striga infestation affects the recruitment of soil microbiome. We characterized the root microbiome composition in the Striga-susceptible genotype, Shangui Red, and Striga-resistant genotype. SRN-39 in the presence and the absence of Striga. Each variety was grown in Striga-suppressive soil and infected with Striga. Microbial composition was profiled over the course of two sorghum developmental stages from the three microbiome compartments: bulk soil, rhizosphere (soil attached to sorghum roots), and endophyte (inside the sorghum roots). Collected data suggest that Striga infection effect differs across the compartments. Further research will explore how the observed variation affects the suppressive properties of the soil.

### Technical Development and Assembly of a Modular Cubesat

#### Jorge Garcia Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The REALOP CubeSat of the University of California, Davis team utilizes a new design that is modular and provides more access to internal payload components. To achieve ease of accessibility and modularity, the structures team designed mounting brackets and a unique printed circuit board (PCB) housing unit that are easy to modify and reorganize without having to take apart the whole satellite assembly. The assembly preparation team is currently working towards a standardized integration plan that carefully documents the process of assembling each payload component. A database of wellorganized and detailed documents was made to tackle the multiple challenges in developing an assembly procedure that independently integrated each of the critical payload components, PCBs, and wire routes with the structural frame. The assembly will consist of installing deployment switches, payload components and their respective mounting brackets, Xfaces, Y-faces, Z-faces, and finally solar panels. These new designs and standardized integration documents will be used for future CubeSat missions and testing.

## Anxiety and Depressive Symptoms as Predictors of Shyness

## Juan Garcia-Cardenas Sponsor: Richard Robins, Ph.D. Psychology

Shyness, or the tendency to feel awkward, worried, or tense during social encounters, especially with unfamiliar people, is a highly prevalent personality trait. Although shyness is a widely studied research topic, more research is needed on how anxiety and depression symptoms influence the development of shyness during adolescence. The present study will test whether symptoms of anxiety and depression at age 10 predict the developmental trajectory of shyness from age 10 to 16. We will use data from the California Families Project, a longitudinal study of 674 Mexican origin youth. In particular, we will examine shyness assessed via the Early Adolescent Temperament Questionnaire and symptoms of anxiety and depression assessed via the NIMH Diagnostic Interview Schedule for Children-IV. We predict that the presence of anxiety and depressive symptoms at age 10 will be associated with increases in shyness from age 10 to 16. To test this, we will model a latent growth curve for shyness from age 10 to 16 and include symptoms of anxiety and depression at age 10 as timeinvariant predictors of the intercept and slope of the trajectory.

*Mayra Garza* Sponsor: Susy Zepeda, Ph.D. Chicano Studies

Death is a part of life that is inevitable. People process and understand the concept of death differently. Chicanx participation in Día de los Muertos offers them an alternative perspective and way to grieve and celebrate the cycles of life and death. A celebration full of traditions that has survived colonization and a global pandemic serves as a day of remembrance for those no longer with us. How does Día de los Muertos create a space for grieving and healing? In this study, I will specifically be looking at Taller Arte del Nuevo Amanecer (TANA) annual Día de los Muertos event to better understand how art plays a role in grieving. An event that incorporates silkscreen prints, altars, and danza. Community members from around the area gather to honor their loved ones. This study will use photographs from the event, interviews with the organizers, and autohistoria-teoría to explore how a space for collective and individual healing is possible. The artwork created for this event will also be analyzed to map the possibilities of using art as a tool for grieving and healing.

# We Journeyed Together - An Online Tabletop Roleplaying Game

Jackson Gaydon Sponsor: Joshua Mccoy, Ph.D. Engr Computer Science

The COVID-19 pandemic has caused the tabletop role-playing game community to adapt to virtual settings, often using voice chat and virtual tabletops. However, these games were not designed to be played online, causing the new format to be awkward. This causes challenges to new players who struggle with joining the hobby due to current games either focusing heavily on the rules and leaving storytelling as secondary, or being rules-light and not having game masters to moderate and ensure the game has an existing structure to follow. This has motivated development of this online tabletop role-playing game, that provides the experience of traveling with a group of people on an adventure to confront a great threat over only a few hours. It follows similar role-playing formats to Fiasco and Weave, but provides a rules-light but rigid structure of play so that it is easier to have an ideal experience. The game design philosophy ensures that any features must be simple to understand and use, leading me to hope that it will fill the current gap in internet-focused, accessible games, which we will be measuring the success of by playtesting over these next few months.

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

#### LupSeat: An Automatic Seat Layout Generator

#### Star Ghanaat Sponsor: Mona Monfared, Ph.D. Molecular & Cellular Bio

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

## UBE3A Transcript and Protein Levels in a Novel Mouse Model for 15q11.2-q13.3 Duplication Syndrome

*Julia Godinez* Sponsor: Janine Lasalle, Ph.D. MED: Medical Microbiology & Imm

Dup15q11-13 syndrome is a neuro-developmental disorder characterized by intellectual disability, autism, developmental delay, hypotonia, epilepsy, and dysmorphic facial features. Dup 15q results from a maternally inherited duplication of the 15q11.2q13.3 region of the human chromosome 15 containing the gene UBE3A. UBE3A is thought to play a role in the development of Dup15q. Therefore, my hypothesis is that mice bearing an extra copy of the Ube3a gene will over-express UBE3A protein and model Dup15q11-13 phenotypes. The LaSalle lab has generated a Dup15g mouse model by inserting an extra copy of Ube3a into the mouse genome using the PiggyBac-on-BAC method. qRT-PCR analysis of Ube3a transgenic mouse brain found that Ube3a transcripts are lower than control littermates. Western blot analysis of mouse brain samples found that UBEA was significantly reduced in Ube3a transgenic mice compared to controls. Therefore, the data was counter to my hypothesis that transgenic mice would show increased levels of UBE3A protein compared to their controls. Additional studies will be necessary in order to confirm these findings in Ube3a transgenic mice. This novel Ube3a mouse model may or may not be a useful tool to further understand the role of UBE3A in Dup15g syndrome and to develop effective treatments.

#### *Hiroya Gojo* Sponsor: Joel Porquet, Ph.D. Engr Computer Science

When students are allowed to sit next to whoever they want in an exam, it may increase the chance of plagiarism and cheating. On the other hand, assigning random seats to students prior to exams is time-consuming, especially for large classes, since instructors have to assign seats by hand. There are also risks of clerical errors, such as forgetting to assign a student. Existing software solutions focus on relatively small classrooms. The goal of LupSeat is to automate the seat assignment process in an easy way to solve this problem. Using an algorithmic approach simplifies the process of spacing out students and minimizes the chance of errors. Different types of algorithms were developed to compare its effectiveness to create a seating layout with the least amount of students sitting together. LupSeat also accounts for other factors such as special needs seats or left-handed vs. right-handed seats. LupSeat is easy for instructors to use and instructors only need to provide student information and the representation of the room layout. The output visualization is very customizable, giving instructors the freedom to format the output how they want it.

## Anogenital Distance as a Biomarker for Prenatal Sex Hormone Exposure in Titi Monkeys

## Carmella Gomez

Sponsor: Karen Bales, Ph.D. Psychology

Prenatal androgen exposure (PAE) influences physiological development, giving rise to sexually-dimorphic biomarkers, including anogenital distance (AGD) and second-to-fourth digit (2D:4D) ratio. However, there are still many questions concerning when and how prenatal sex hormones affect these biomarkers, and few studies have attempted to correlate biomarkers, particularly in animal models. The purpose of this study was to assess AGD in titi monkeys (Plecturocebus cupreus), a promising nonhuman primate model for human development. We hypothesized (1) that AGD would be sexually dimorphic; (2) that AGD would correlate with 2D:4D ratio; and (3), that AGD would correlate with circulating maternal sex hormones during pregnancy (determined from urine samples). Subjects were 74 adult titi monkeys (40 males, 34 females). AGD and 2D:4D ratio were measured using standard conventions while subjects were sedated for routine health examinations. For 24 subjects, maternal testosterone and estrone-1C-conjugate were assayed from archived urine samples obtained during the first trimester of pregnancy. Data analysis is in progress and will be completed using t-tests and multiple regression. The results of this study will have implications for how biomarkers of PAE are interpreted in future studies.

#### Inhibition of Glycolysis to Promote Tendon Formation

## Nicole Gonzales Sponsor: Michael Mienaltowski, D.V.M.,Ph.D. Animal Science

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

## The Aurora B Kinase Regulates ESCRT-III Machinery in Replication Stress Induced Nucleophagy

Joseph Gonzales Sponsor: Kenneth Kaplan, Ph.D. Molecular & Cellular Bio

Proper sister-chromatid resolution during anaphase is critical to maintain chromosome stability, and defects can result in micronuclei that contribute to further chromosome instability. The Kaplan lab has characterized a pathway known as ReSIN (replication stress induced nucleophagy), which we propose suppresses the formation of micronuclei by targeting them for degradation in lysosomes. What pathways regulate ReSIN remain unknown. The Aurora B kinase is known to regulate multiple events in anaphase, including the activity of the ESCRT-III, a complex important for abscission or more generally the sealing of double membranes organelles (e.g. nuclear envelopes and autophagosomes). We hypothesize that the Aurora B kinase regulates nucleophagy through ESCRT-III membrane closure events in the presence of unresolved sister chromatids induced by replication stress. To test this, we will induce replication stress with hydroxyurea and chemically inhibit an analogue sensitive allele of the Aurora B kinase in budding yeast and measure ESCRT-III localization. We predict that the Aurora B kinase is required to regulate ESCRT-III, preventing localization at phagophore assembly sites and the trafficking of cargo important for nucleophagy into the vacuole, resulting in the accumulation of vesicular intermediates.

#### Environmental Burden and Incarceration at a Crossroads: A Quantitative Analysis of Incarceration Rates and Environmental Quality in the State of Georgia

#### Braulio Gonzalez Sponsor: Clare Cannon, Ph.D. Human Ecology

Intersectional environmental and incarceration justice data tools (ex. VERA, EJ SCREEN) highlight the intersection of these issues with economic and social indicators. We seek to understand the relationship between countywide incarceration rates and environmental quality using Georgia counties as a case study. Georgia state suffers from disproportionally high levels of incarceration nationwide (PPI). Using data from the VERA Institute of Justice (2014) and the US Environmental Protection Agency Environmental Quality Index (2013), we employed bivariate correlation and OLS regression to analyze the rate and association between county incarceration environmental aualitv compared to individual-level sociodemographic, behavioral, and socioeconomic characteristics. We found that environmental quality was most associated with incarceration rate (95% Confidence Interval [CI]= Beta .47), while all other variables also had a significant relationship. Among Georgia counties for which there are data (n = 157), the association between county incarceration rate and environmental quality (determined by US EPA environmental quality index) may be explained by existing sociodemographic disparities and complex environmental justice issues. Policymakers should consider the intersection between incarceration and the environment when shaping incarceration and environmental policy. Future research should include a qualitative analysis of communities at the intersection of incarceration and environment quality.

#### Post Covid19 Air New Zealand Marketing Plan

*Eva Goodisson* Sponsor: Douglas Findlay, M.B.A. Graduate School Of Management

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

#### Prehistoric Hafting in South Africa

Brian Graves Sponsor: Teresa Steele, Ph.D. Anthropology

During Africa's Middle Stone Age (MSA), the archaeological record reveals a significant increase in behavioral variability, including early personal ornaments and art. Excavations in South Africa have found at least 23 MSA sites with rich concentrations of ochre, guarried elsewhere and often imported. Ethnographic accounts and replication studies have demonstrated that this substance was likely used as a loading agent for adhesives crafted using Acacia resin. The archaeological record has preserved this mineral in conjunction with many lithic points, some bearing the traces of plant resins indicative of hafting. Experimental archaeology is required to link these materials to their potential use with hafted spears. Did blunting or backing of stone points increase the efficacy of adhesives? Were firing or drying conditions carefully controlled during adhesive manufacture or application? Did gains in durability make complicated construction worthwhile or could people fashion these implements in a time-efficient manner? Lacking firsthand accounts, experimental archaeology affords researchers a means to simulate the creation of adhesives. This project provides a detailed literature review of the ethnographic and archaeological record for adhesive manufacturing and use and proposes an experimental design to investigate the energetic trade-offs of production.

#### Disparities in breastfeeding initiation and continuation among women with substance use during pregnancy

*Kathleen Groh* Sponsor: Laura Kair, M.D. MED: Pediatrics

Breastfeeding is critically important for maternal and infant health across the life course. Prenatal tobacco and illicit substance exposure increase offspring risk for sudden infant death syndrome (SIDS), while breastfeeding decreases SIDS risk. However, clinical practice guidelines offer conflicting recommendations about breastfeeding for women with substance use. This study of 2016-2018 CDC Pregnancy Risk Assessment Monitoring System data determined the extent to which women who report tobacco and/or illicit substance use during pregnancy initiate breastfeeding and continue for at least 6 weeks compared to women without these exposures. Using weighted Rao-Scott chi-square tests, we examined the association of substance use with breastfeeding initiation and continuation. Data from states that collected information on perinatal substance use, breastfeeding initiation, and breastfeeding continuation was used. Weighted, multivariable logistic regression was used to estimate the odds of breastfeeding initiation and continuation for women with and without prenatal substance use while adjusting for relevant characteristics. We found women with prenatal smoking and substance use are less likely to initiate breastfeeding and continue breastfeeding. Similarly, women who initiated breastfeeding and used illicit substances were also less likely to continue breastfeeding. These results underscore the need for interventions to boost breastfeeding in this vulnerable group.

## Experimental Assessment of a Novel Fixative for Ichthyological Applications

*Allison Grygar* Sponsor: Levi Lewis, Ph.D. Wildlife & Fisheries Biology

Excell Plus is an emerging glyoxal-based fixative that serves as a less toxic alternative to formaldehyde for preserving biological tissues for histology and genomics. Though tested in these areas, its preservation of whole organisms and calcified structures (e.g., fish otoliths) for ichthyological studies remains poorly described. We examined differences in the preservation quality of whole Delta Smelt, an endangered native California fish, and their otoliths that were preserved in Excell Plus, liquid nitrogen, 95% ethanol, or 10% formalin for one week and one month. For whole fish, we contrasted preservation-based changes in length, mass, body depth, color, and eye diameter. For otoliths, we examined effects on size, structural integrity, microstructure guality, and elemental signatures. If Excell Plus preserves specimens in comparable or improved condition relative to other preservatives, it could be considered a preferred alternative that reduces hazards while maximizing specimen preservation for multiple uses. However, if Excell Plus preserves otoliths or whole specimens in worse condition than other preservatives, it may only be valuable for specific applications. This study contributes new information to inform and improve upon standard field and laboratory protocols in ichthyology.

#### Using Social Disorganization Theory to Understand Police-Community Interaction in a Multi-Ethnic City: A Quantitative Study on Police Behavior in San Diego

Sheridamae Gudez Sponsor: William Mccarthy, Ph.D. Sociology

Recent expansions of social disorganization theory focus on minority communities, highlighting that racial segregation is linked to crime. The existing literature fails to expand on the relationship between non-Black communities, policing, and crime. This study adds to this literature by analyzing San Diego, a diverse community, and assessing if similar relationships between different communities, policing, and crime exist. This study asks: 1) Do communities in San Diego City that experience various forms of social disorganization have a greater police presence? 2) Do communities with large minority populations experience more engagement with law enforcement than communities that have larger white populations? In this study I amassed, cleaned, and analyzed 21,138 police reports matched to census tracts within San Diego. I estimated negative binomial regression models predicting police reports to analyze the relationships between community characteristics and police behavior. Results indicate that communities with greater percentages foreign-born populations, divorced, or low homeownership are linked to more police reports. While communities with large Asian or Hispanic populations, high median income, or high homeownership are linked to lower police reports. This study suggests a need for community enriching programs, and a deeper analysis between law enforcement interactions and immigrant communities in multiethnic cities.

## Linking the Foraging and Breeding Behaviors in Lekking Species

#### *Alexa Guerrero* Sponsor: Eric Tymstra, Ph.D. Microbiology & Molec Genetics

It's well established that breeding and foraging behaviors depend on individual decisions, but little is known about how decisions are connected across contexts. To improve conservation efforts of wild species and critical habitat, it's essential to understand how animal decisions of foraging and breeding are linked. The current research focuses on breeding behavior in the Greater sage-grouse, a lekking bird that feeds exclusively on chemically-defended sagebrush during the breeding season. Male sage-grouse display for several hours each morning on a lek (display ground) during the breeding season and forage on toxic sagebrush in the afternoons. We will be connecting the individual decisions on and off-lek and how they influence off-lek foraging behavior to the on-lek breeding behavior, which are essential to male survival and reproductive success that incur high physiological costs. Using videos taken on leks during the breeding season, I will quantify male breeding behavior by recording successful copulations, aggression display rates, and male-male aggressive interactions. This breeding behavior data will be paired with chemical foraging data collected from GPS-tagged males. Linking foraging and breeding behaviors in sage-grouse will allow researchers and managers to understand how habitat quality affects reproductive success and, more broadly, population processes in other herbivores.

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

XANDER GULDMAN Sponsor: Jonathan London, Ph.D. Human Ecology

To many, electric vehicles symbolize an important step toward an environmentally sustainable future. The lithium used in EV batteries, however, carries a heavy social and environmental cost. The water intensive process by which lithium is mined has rapidly depleted the water table in Chile's Atacama desert, which is home to the most extensive lithium reserves in the world as well as the indigenous Atacameño people. This paper seeks to understand the impact that lithium extraction has on the Atacama's indigenous population, and how water is managed in this fragile ecosystem. Semi-structured interviews were conducted with individuals from indigenous and environmental advocacy groups in the Atacama to shed light on the above topics. This paper was also informed by existing literature addressing the impacts of lithium mining on the Atacameño community. Preliminary findings emphasize that water shortages have compromised the Atacameño community's ability to engage in traditional subsistence agriculture and is causing irreversible cultural damage to this indigenous community. Economic motivations at the state and corporate levels guide how water is managed and distributed in the interests of national and global capital in ways that interfere with local health and livelihoods.

Naijing Guo Sponsor: Mohamed Hafez, Ph.D. Mechanical & Aerospace Engr

As computers are becoming more and more accessible and powerful, they have become an essential tool especially for STEM fields - a large number of science experiments and engineering projects can be simulated by computers. In the same vein, fundamental theories in science and engineering can also be readily simulated and illustrated using simple mathematical models, and thus become more intelligible to students. Along with computer simulation, hand-on experiment is another way to make theories more comprehensible to students. In this special circumstance of the pandemic, however, traditional experiments in the science lab setting are not available to students anymore, making the designing of simple home experiments much needed. This project focuses on the computer simulation and home experiment methods on the following topics: solving initial value problems for ordinary differential equations, numerical evaluation of exponential function and numerical evaluation of trigonometric function. In each of the problem category, we will investigate one or more physical problem scenarios - in particular, we will study the oscillations of Yoyo and the pendulum problem with and without damping effects, find their mathematical descriptions and analytical solutions, and present our computer simulations and home experiments methods and results.

## Development of a Reliable, Low-Cost Reaction Wheel for CubeSat Attitude Control

Anjali Gupta Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

This presentation discusses the development of a low-cost Manufactured Reaction Wheel (MRW) system for the REALOP mission, UC Davis's first and completely undergraduate-led CubeSat mission. Commercial reaction wheel systems typically exceed budgets for university missions, so the motor and reaction wheels are independently acquired and joined with a thermal-press fit to ensure cost-effectiveness and reliability. Once in orbit, the MRW will autonomously stabilize and precisely orient the CubeSat so that the satellite's visible light and infrared cameras can take clear photos. The MRW control systems team is developing a methodology to find a PID controller which meets the mission requirements. This process begins with finding a model of the system, applying and tuning the controller, then verifying results with physical testing. A general approach allows for testing on low-cost motors, in preparation for quick and safe tuning of the assembled MRW. Many university CubeSat missions are hindered by the expense of reaction wheel systems; successful use and thorough documentation of REALOP's Manufactured Reaction Wheel system will provide future missions with easier access to lowcost, reliable reaction wheel systems.

## The Effects of Social Exclusion and Familism on Prosocial Behaviors in Mexican-Origin Adolescents

## *Ritika Gupta* Sponsor: Paul Hastings, Ph.D. Psychology

Social exclusion has detrimental effects on development by threatening psychological needs (e.g., belonging, self-esteem). However, familism (i.e., the prioritization of the family unit) has been found to buffer against these detrimental effects in Latinx youth, and even promote positive social adjustment behaviors, such as prosocial behaviors, which are actions intended to benefit others. However, these assessments have been limited to self-report assessments. Autonomic nervous system (ANS) reactivity is regarded as a biomarker for emotion regulation and may reveal underlying effects of how social exclusion impacts youth. In this study, familism was examined as a moderator between adolescent ANS reactivity to social exclusion and prosocial behaviors. 229 Mexican-origin adolescents (113 females, mean<sub>age</sub> = 17.16 years,  $SD_{age}$  = .41) were recruited to participate in the study. ANS reactivity during social exclusion did not significantly predict prosocial behavior engagement. However, familism significantly and positively predicted engagement prosocial behaviors ( $\beta = .27$ , p < .001). Familism did not significantly moderate the association between ANS reactivity during social exclusion and prosocial behaviors. Therefore, familism may be an effective way of promoting prosocial behaviors in Mexican-origin adolescents. These findings suggest that familism may in fact not effectively buffer against physiological responses to social exclusion.

# Why it is important to protect Wastewater Essential Workers during COVID-19

Jessica Ha Sponsor: Maureen Kinyua, Ph.D. Civil & Environmental Engr

In this COVID-19 pandemic, essential workers have been brought to our attention and magnified the importance to protect them. Among those, wastewater personnels are a more susceptible group to pathogen exposure. In other words, groups that are at high risk of viruses such as COVID-19. As such, it is important to determine their risk of exposure to SARS-CoV-2 when providing essential service to the public. Therefore, we conducted a national survey of wastewater treatment personnels to gather information about their access and use of PPE and determine other health indicators that may affect their susceptibility to wastewater pathogens. With 243 survey responses, results illustrated that over 34% of workers are directly exposed to wastewater half of the time at work. In the future, we will conduct a quantitative microbial risk assessment with information gathered from this national survey to determine the occupational exposure to SARS-CoV-2 in the wastewater treatment plant. We hope the result of this survey can elucidate the current situation in wastewater treatment plants and provide valuable information for industry and public health officials on how to be prepared for pathogens that are transmittable through wastewater.

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

Sabrina Habchi Sponsor: James Adams, Ph.D. Political Science

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

## What Makes a Successful Legislator in the California Legislature

Alisha Hacker Sponsor: Scott Mackenzie, Ph.D. Political Science

The California State Legislature is one of the most influential policy chambers in the country. California has 40 million citizens and is the 6th largest economy, which makes the decisions made in Sacramento very important. Being an effective legislature in the California State Legislature can allow a member to pass significant and influential legislation. This paper defines what qualities the most effective legislators in California State Legislature possessed during different times in the last decade since the passage of term limit rules which led to a new generation of legislators in California after 2012. This research creates a profile of qualities that a successful legislator possesses by analyzing which legislators passed the most and the least bills. Then, this project determines which characteristic legislators performed above average mutually possessed. The characteristics were members with law degrees, women, who have served above-average years in the legislature, or Democrats to test if they had a legislative advantage.

## Investigating the Role of SEMA3C in Pacreatic Ductal Adenocarcinoma

Madison Hall Sponsor: Changil Hwang, D.V.M.,Ph.D. Microbiology & Molec Genetics

The five year survival rate of pancreatic cancer is 10%, the lowest among the most common cancer types. While 95% of pancreatic ductal adenocarcinomas (PDAC) carry mutations in the KRAS gene, targeting the KRAS protein directly has proven difficult. Instead, researchers are trying to target proteins downstream of KRAS for therapeutic benefit. Previous studies suggest that KRAS mutated cancers are more likely to be reliant on autophagy, a survival mechanism where cells recycle their unnecessary cellular components for energy. I hypothesize that this process may be targetable for treatment of PDAC and aim to identify potential drug targets. Using existing single cell RNA sequencing data from PDAC patients, I found that SEMA3C, a gene associated with a specific mutation of KRAS, is primarily expressed in pancreatic tumor cells and fibroblasts, and is upregulated in tumor cells compared to normal cells. Additionally, gene set enrichment analysis showed that SEMA3C positive cells are enriched for the autophagy gene signature, suggesting that the SEMA3C protein is involved in the regulation of autophagy in PDAC and is a potential target for treatment.

## The Effects of Taxonomic and Thematic Related Objects on Visual Perception

*Fayann Han* Sponsor: Joy Geng, Ph.D. Psychology

We naturally learn that all objects that we interact with are associated with one another. Some objects we learn to associate with each other based on repeated visual experiences (e.g., a helmet is usually worn when on a bike; thematic information). Other objects, we learn to associate based on physical and non-physical similarities (e.g., dogs, and whales are both warm-blooded and give birth and hence mammals; taxonomic information). An important distinction between these two types of information is how it is acquired. Given this dichotomy, it is critical to understand if the source of learned associations between objects has a direct influence on how we perceive them. Through three behavioral experiments, we provide evidence that learned visual co-occurrence of thematically related objects result in faster perceptual grouping compared to taxonomically related objects. Overall, these results demonstrate that learned co-occurrence (thematic relationships) contribute to our semantic knowledge and also influence low level visual processing, illustrating a link between how information is learned and how it regulates visual perception.

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

### Madeline Handy Sponsor: Rachel Vannette, Ph.D. Entomology/Nematology

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

## A Qualitative Analysis of Black Educators' Perspectives on Black Childrens' Need For School Success

*Minhal Hanif* Sponsor: Faheemah Mustafaa, Ph.D. Education

A variety of factors influence children's academic achievement. This qualitative study explores the diversity of perspectives present amongst Black educators regarding what they believe Black students need to be successful in school. A group of 238 K-12 educators who self-identified as Black or African American, across the U.S. plus Washington D.C., were asked to respond to an open-ended question within a larger survey study: "What do African American/Black children need in order to be successful in school today? Please explain." We conducted a thematic open coding analysis of the responses. Our analysis showed overarching themes of social, institutional, and emotional support as key factors that play a role in the academic success of Black students. The responses to this open-ended question have helped to illuminate the kinds of support that Black educators believe Black students need to be successful in school today. The findings of this study may be utilized to inform educators, policymakers, parents, and others in future decision-making around children's academic pathways, laws, and policies in a way that takes into consideration their intersectional identities and backgrounds.

# Virus-based immunosorbent nanoparticles to purify antibodies from proteins

## Olivia Hart Sponsor: Karen Mcdonald, Ph.D. Chemical Engineering

Viral nanotechnology is becoming more popular in biomedicine and materials science for its numerous potential applications, one of which is pharmaceutical protein purification. Plant virusbased immunosorbent nanoparticles (VIN) display proteins on its surface capable of binding to antibodies or Fc-fusion protein pharmaceuticals. VINs are being researched to serve as a component of a pharmaceutical purification scheme for limited resource environments, addressing the need to overcome the cost and complexity of current manufacturing solutions. Plant viruses are a particularly appealing nanomaterial base because of the simple production in plants and inherent biosafety as noninfectious to humans. The concept of using VINs to capture antibodies has already been established. Here we describe our work to expand the utility of this promising virus-based nanomaterial by developing a new method wherein the VINs are used to capture arbitrary proteins via antibody intermediates. We specifically emphasize development of dissociation and separation mechanisms to capture the arbitrary protein from the antibody and VIN.

## Identification of Potential Osmoregulatory Transcription Factors in Mozambique Tilapia (Oreochromis mossambicus)

## Lorna Haworth Sponsor: Dietmar Kueltz, Ph.D. Animal Science

Tilapia are an important worldwide aquaculture species as they have fast growth and a high environmental stress tolerance. Stressful environments present themselves as variability among temperature, salinity, dissolved oxygen, etc. In the context of climate change, it is increasingly necessary to study species responses to stress in order to predict and mitigate potential effects on species diversity and biological performance. One compensation mechanism during salinity stress involves the adjustment of regulation of the expression of osmoregulatory genes. In this study we have identified 21 genes that are induced by salinity stress in tilapia. We show that salinity induction is mediated by transcriptional regulation and hypothesize that regulation of 21 genes is due to a common osmotically inducible enhancer element in their 5' regulatory region. Using the bioinformatics tool MEME-Suite, these 21 sequences were analyzed to find motifs that represent binding sites for salinity-inducible transcription factors. This study identified two motifs and two corresponding transcription factors that are common to all 21 sequences. Our findings pave the way for future experimental validation of biological activity for these motifs using reporter assays such as Luciferase or GFP reporters.

#### **Governance in Economic Recovery**

#### Zhengqian He Sponsor: Giovanni Peri, Ph.D. Economics

Watching different responses to the economic fallout from COVID-19, I wondered how big a role institutional quality can play in economic recovery since countries with better governance failed to contain the negative economic influence this time. Therefore, I researched on correlation between governance and recovery levels, specifically in two era, Asian Financial Crisis and the Great Recession. I utilized data on six governance variables from the Worldwide Governance Indicator and generated a dependent variable of efficiency of recovery using the summation of output gap in 3/5/7 years following a crisis. I have treated the data as a short two-episode panel and two cross-sectionals, and formed regression based on OLS and Fixed Effects. The ultimate goal is to check if any institutional quality factors play a significant role in economic recovery. Current results have shown a positive correlation between Voice and Accountability and recovery, but a negative correlation for Rule of Law. Also, the effect is more salient for the Asian Financial Crisis than the Great Recession.

# Comparison of Machine Learning Models for Image Classification

# Sameerah Helal

Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The purpose of this project is to teach UC Davis's first CubeSat when to collect pictures and IR sensor data. The Space and Satellite Systems (SSS) Club has developed a CubeSat that lays the foundation for low-cost missions focused on Earth Science. This mission objective relies heavily on the problem of when to collect data and ensuring the quality of our data. This is accomplished through machine learning and information theory and processing by the Computer Systems Team of SSS. After dedicated research from the Computer Systems/Machine Learning subteam, we have compared and contrasted three methods for teaching our CubeSat: Linear Regression, Logistic Regression, and Support Vector Machine. Our results were verified with mathematical optimization. We are developing a novel data set, which is highly sought after in Machine Learning research, to further test our methods. Future work will include a novel method that will not only teach the machine but allow it to actively learn at low cost to our power systems.

## Heng is Cambodian for Luck: How my Father Escaped The Cambodian Genocide

Jarod Heng Sponsor: Andrew Smith, M.A. Cinema & Digital Media

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

## Examining the Co-development of Shyness and Acculturation Across Mexican-Origin Youth: A longitudinal Study

## *Isidro Hernandez* Sponsor: Richard Robins, Ph.D. Psychology

Shyness, or inhibition when engaging with unfamiliar others, is an important personality trait. Culture, and particularly the acculturation process in which individuals experience changes in cultural orientation, might influence how shyness develops within individuals (Gudiño & Lau,2010). However, few studies have examined how acculturation factors, such as language use and generational status, are associated with the development of shyness in Mexican-origin youth across adolescence.

In this study, we will examine the co-development of shyness and acculturation from age 10 to 16, using data from a large. longitudinal study of Mexican-origin youth(N=674). We expect first-generation youth to show higher initial levels of shyness than youth born in the U.S. Additionally, we expect youth with higher English proficiency to show greater decreases in shyness across adolescence, and vice versa. We will assess shyness using the Early Adolescent Temperament Questionnaire (Ellis & Rothbart, 2001), and Spanish and English language using the Hazuda Acculturation and Assimilation Scale (Hazuda et al. 1988). We will run bivariate latent growth curve models to test our predictions and use multi-group models to examine whether gender moderates the associations between acculturation and shyness. The findings may have implications for developing culturally-tailored interventions to help Mexican-origin youth reduce their shyness.

*Rachel Hirota* Sponsor: John Eadie, Ph.D. Wildlife & Fisheries Biology

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

## The Role of Migratory Status on Changes in Phenology in Response to Climate Change in Seabirds

Rachel Hirota Sponsor: Joshua Hull, Ph.D. Animal Science

Approximately one-third of seabird species are vulnerable or endangered, making them the most threatened species-group of birds. All with invasive species and bycatch, climate change is one of the main global threats to seabirds. As climatic changes alter resource availability, the ability for animals to alter their behavior in response to climate change has consequences for fitness and population ecology. There is increasing evidence that arrival and breeding dates have advanced in birds overall; however, this advancement is heterogeneous among species. The reduced amount of change in phenology among longdistance migrants compared to short-distance migrants and resident birds suggests that long-distance migrants have limited ability to respond to climatic changes. While a number of studies have investigated changes in mean lay dates in response to climate change, few have focused on migratory status' role on the species-group level, especially seabirds. This meta-analytic study aims to determine the plasticity of phenology in seabirds in response to climate change in relation to migratory status. Here, we relate changes in mean lay and hatch dates over time by seabirds in temperate and polar regions to their migratory status while using changes in sea surface temperature as an indicator of climatic change.

Extracellular Matrix Mimicking Nanofibrous Scaffolds Modified With Mesenchymal Stem Cell-Derived Extracellular Vesicles for Improved Vascularization

> *Megan Hoang* Sponsor: Aijun Wang, Ph.D. MED: Surgery

Naturally occuring extracellular matrix (ECM) is critical to inducing tissue regeneration through their network structure and biological components. The ECM architecture can be mimicked via electrospun nanofibrous scaffolds, which provide structural support for cell growth and tissue regeneration. However, the electrospun nanofibrous scaffolds do not possess biological activity. Extracellular vesicles (EVs) have strong intercellular communication capabilities by transferring RNAs, proteins, and lipids. Therefore, EV modified electrospun scaffolds, mimicking the structure and the physiological interactions between the ECM and EVs, are a potential strategy for mediating significant biological function. Previously, we identified LLP2A, an integrin a4ß1 ligand, which had a strong binding to human placentaderived mesenchymal stem cells (PMSCs). In this study, we isolated PMSCs derived EVs (PMSC-EVs) and demonstrated that the expression of integrin a4ß1 could improve endothelial cell (EC) migration and vascular sprouting in an ex vivo rat aortic ring assay. We found that LLP2A PMSC-EV modified electrospun scaffolds significantly promoted EC survival and angiogenic gene expression and suppressed the expression of apoptotic markers. Thus, PMSC-EVs hold promising potential to functionalize biomaterial constructs and improve vascularization. The EVs modified biomaterial scaffolds can be widely used for different tissue engineering applications, making them a versatile tool for regenerative medicine.

# Measurement of the Space-Charge Region Width in BiVO<sub>4</sub> Particle Films with Surface Photovoltage Spectroscopy

**Brett Hodges** Sponsor: Frank Osterloh, Ph.D. Chemistry

The use of semiconducting materials, such as bismuth vanadate (BiVO<sub>4</sub>), as nanoparticulate catalysts for photocatalytic watersplitting depends on the nature of electronic-band bending phenomena at the semiconductor-liquid interface. Electric fields present at this interface reduce the concentration of majority charge carriers within a region of the semiconductor, creating what is commonly referred to as a depletion/space-charge region (SCR). Currently, models based upon bulk semiconductor systems are used to measure the width of this SCR and relate it to electronic properties of the system, such as charge carrier density and interfacial voltage. A recent study has indicated that the SCR of nanoparticle systems can be effectively investigated with surface photovoltage spectroscopy (SPS). In this work, we utilize SPS to probe the SCR width in BiVO<sub>4</sub> particle films. Photoactive BiVO<sub>4</sub> particles with an optical bandgap of 2.49 eV were produced via a liquid-assisted solid-state synthesis. Films were prepared on gold-coated glass substrates via electrophoretic deposition and subsequently annealed. Characterization with optical microscopy and diffuse reflectance spectroscopy was conducted. Based on previous findings, the observed SCR width is predicted to be orders of magnitude larger than that calculated from bulk system models. The current status of SPS characterization is to be discussed.

## Extracellular Matrix Mimicking Nanofibrous Scaffolds Modified With Mesenchymal Stem Cell-Derived Extracellular Vesicles for Improved Vascularization

## Christopher Holden-Wingate Sponsor: Aijun Wang, Ph.D. MED: Surgery

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## Facial Emotion Perception and Theory of Mind in Preschool Children

Aditi Hosangadi Sponsor: Lindsay Bowman, Ph.D. Psychology

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

## Achievement Gaps and Gender Disparities in Higher Education

*Christine How* Sponsor: Kristin Kiesel, Ph.D. Ag & Resource Economics

The gender distribution in the Agricultural and Environmental Sciences Department at UC Davis is fairly equal, with even more female students in some STEM majors, but are women in STEM majors still having a more difficult time than men, in terms of learning experience and outcomes? According to the U.S Department of Labor, "women are still underrepresented in STEM occupations, with women's share of computer workers actually declining since 1990." This research uses regression analysis to investigate the underrepresentation of women in STEM disciplines, and the effect switching to remote instruction has on academic outcomes. The dataset incorporates 1972 observations and 111 variables of students in three STEM majors at UC Davis (Managerial Economics, Economics, and Environmental Sciences and Management), each with a different gender distribution. Academic outcomes are defined as grades in the major core classes; by regressing grades from preparatory classes or exams on subsequent classes, while controlling for variables including gender, admission status (highschool admit/transfer), and class gender distribution, this research will examine the significance of each factor in determining academic success/failure. The findings of this research will further the understanding of the higher education system, especially in overcoming achievement gaps in STEM majors.

# The Impact of COVID-19 on the Mental Well-Being of the Asian Pacific Islander American (APIA) Population Ages 18-30 Residing in Yolo and Sacramento, California

*Tan Hua* Sponsor: Christian Bohringer, M.D. MED: Anesth & Pain Medicine

Coronavirus disease 2019, or COVID-19, is an infectious communicable respiratory illness that has affected over 100,000 people throughout Sacramento and Yolo County. During the pandemic, social distancing and lockdown measures were put in place to ensure the safety of our communities. Mental health issues have become relatively common in the youth group due to social isolation. Our aim is to investigate, to what degree has COVID-19 impacted the mental well-being of the Asian & Pacific Islander American (APIA) community, ages 18-30, residing in the Yolo County and Sacramento City/County, CA region compared to the Caucasian population? Our online survey asks participants to rate statements based on their mental health, healthcare access, and academic performances. Our survey was opened from January 20th, 2021 to February 3rd, 2021. Our sample group (n = 147) consisted of 32 participants identifying as Caucasian and 94 participants identifying as Asian/Pacifier Islander. Our data suggest that Caucasian and APIA communities are experiencing depressive symptoms. However, the APIA community reported having a higher impact of negative effects related to depression, anxiety, mood, and stress levels. In conclusion, there should be more resources to support the APIA community regarding their mental well-being, especially during this time.

Victoria Huang Sponsor: Michele La Merrill, Ph.D. Environmental Toxicology

Non-alcoholic fatty liver disease (NAFLD), defined as excessive lipid accumulation not caused by alcohol, is becoming increasingly prevalent among countries where a Western diet (WD) predominates. Affecting about 25% of the US population, NAFLD is the leading cause of chronic liver disease with no approved medical treatment. The epidermal growth factor receptor (EGFR), a transmembrane receptor tyrosine kinase (RTK) activated to control cell proliferation and differentiation, is highly expressed in the liver and its overexpression is shown to play a role in regulating lipid metabolism and NAFLD progression. Research methods involved a literature review approach to compile current knowledge of EGFR signaling network and upregulation of de novo lipogenesis (DNL) through scientific literature and murine model studies. This review revealed that in NAFLD-induced mice studies, EGFR inhibition (EGFRi) was shown to downregulate transcription factors governing DNL, which suggests the potential of EGFRi as a promising treatment. Additional studies showed that in WD-fed mice, proliferation of cells was upregulated by EGFR, and therefore regeneration was enhanced, which demonstrates induction of mild NAFLD may be beneficial after hepatectomies. However, further work illustrating regulation of EGFR on DNL in liver cells specifically is necessary to develop an effective therapy.

# Investigating the Role of Polyfluoroalkyl Substances in DNA Methylation and Pancreatic Adenocarcinoma Progression

Cynthia Huang Sponsor: Changil Hwang, D.V.M.,Ph.D. Microbiology & Molec Genetics

Pancreatic adenocarcinoma (PDA) is the third leading cause of cancer-related death in the United States with a 10% five-year survival rate. Recent research has shown that epigenetic alterations, such as DNA methylation, could facilitate PDA metastasis. Poly and perfluoroalkyl substances (PFAS), compounds commonly used in commercial products, are positively correlated with certain human malignancies, including PDA. How PFAS promotes PDA progression is unknown, but studies have shown that PFAS can alter DNA methylation in vitro and in vivo. Therefore, we hypothesize that PFAS facilitates PDA progression by altering the DNA methylation landscape. To test the hypothesis, we will first treat murine normal and PDA organoids with PFAS. Next, gene expressions of the DNA methylation enzymes will be analyzed using reverse transcription quantitative PCR (RT-qPCR). Finally, we will profile the genome-wide DNA methylation of the organoids and identify differentially methylated regions using reduced representation bisulfite sequencing. We expect PFAS treatment will induce gene expression changes in DNA methylation enzymes, potentially leading to widespread changes in the DNA methylation landscape. Our data will hopefully provide the molecular mechanism of how PFAS exposures promote PDA progression and support health intervention to reduce PDA risks.

*Jin Huang* Sponsor: Li Tian, Ph.D. Plant Sciences

The widely recognized public health issue of vitamin A deficiency can be addressed by increasing provitamin A ßcarotene content in major cereals like wheat through biofortification. However, the turnover of ß-carotene, partially controlled by ß-carotene hydroxylase (HYD), to downstream products reduces its accumulation in wheat grains. Although grains of hyd mutant plants with abolished HYD function accumulate more ß-carotene, the growth and development of mutant plants with perturbed carotenoid metabolism needs to be evaluated. We measured the growth phenotypes of seedlings, flag leaves, and whole shoots in 11 combinatorial mutants in HYD-A1, HYD-B1, HYD-A2, and HYD-B2 gene homoeologs alongside a control. We found that the hyd-a1 hydb1 hyd-a2 hyd-b2 quadruple mutant seedlings grew distinctively slower in light condition, but faster in dark condition relative to the control. The quadruple mutants also matured slower and appeared paler relative to other mutant lines with a functional copy of HYD. Interestingly, the specific leaf areas of flag leaves in the quadruple mutant were not substantially different from other lines. Our result provided insights into the contribution of HYD genes and their homoeologs in plant growth and development, which can be used to select the appropriate mutant combinations for vitamin A biofortification in wheat.

#### Septins Respond to Expression of Neurodegenerative Proteins to Regulate Autophagy and Cell Viability

*Emily Huang* Sponsor: Kenneth Kaplan, Ph.D. Molecular & Cellular Bio

Alpha-synuclein is a neuronal protein involved in forming neurotoxic aggregates, typically observed in Alzheimer's and Parkinson's diseases. These aggregates are thought to induce a proteotoxic response in cells that includes autophagy activation. Septins are a class of cytoskeletal proteins associated with cellular membranes. Evidence from the Kaplan lab suggest they allow for proper autophagy regulation during nutrient starvation by re-organizing on the cell cortex to limit autophagosome formation. I hypothesize that under alpha-syn induced stress, septins will organize at the cell cortex and limit autophagy to preserve cell viability. The septin-encoding CDC10 gene tagged with green fluorescent protein (Cdc10-GFP) was expressed in control cells and in cells under 3hrs of alpha-synuclein overexpression. Preliminary data has indicated that cellular responses involve a reduction in the percent of cells with collars and rings, and an increase of Cdc10-GFP signal at the cortex. In cells expressing alpha-synuclein, there is increased disorganization and variability in septin structures. For more insight into septin organization at the cortex, I will use image processing approaches of optical deconvolution and machine learning to enhance image resolution. With this approach, we hope to better understand how septin re-organization at the cell cortex regulates autophagy after alpha-syn induced proteotoxic stress

*Qihua Huang* Sponsor: Debbie Fetter, Ph.D. Nutrition

In the US, about 7 of 10 individuals use social media to seek out information. However, this widespread use of social media means there is an increased risk of finding false information, especially for health-related topics.

Message framing is a fundamental component of communication strategy that can influence exposure of a message. Messages can be framed to emphasize either the benefits of engaging in a behavior (a gain-frame), the consequences of failing to participate in a behavior (a loss-frame), or the potential danger of not adopting recommendations (a fear appeal).

This study will develop gain-framed, loss-framed, and fearbased health messages to investigate the response between a population with high-use of social media versus one with lowuse. Participants will complete a survey about their social media use, perceived level of knowledge about these health topics, and responses to these health messages in the different framings. Questions will be included to measure perceived accuracy, how likely they would be to share the message with their social network, and self-efficacy towards behavior change. The results can be used to investigate how to more effectively disseminate health messages over social media to help individuals adopt beneficial behaviors.

# **Titanium Intercalation into 2D Layered Materials**

*Vicky Huynh* Sponsor: Kristie Koski, Ph.D. Chemistry

Bismuth Selenide (Bi2Se3) is a 2D layered nanomaterial that has attracted much interest in recent years as it is a novel topological insulator. Bi2Se3 has incredible chemical potential because its chemical and physical properties can be tuned through intercalation, the insertion of a guest species into a host material. In this work, two novel wet chemical strategies are introduced to intercalate atomic titanium into a 2D layered chalcogenide. In the first method, zero-valent titanium is created through reduction of a halogenated titanium precursor with tin chloride in tetrahydrofuran. The second method takes inspiration from the Kroll Process, an industrial process that uses magnesium metal to completely reduce titanium chloride (IV) (TiCl4) without additional refining. Magnesium shavings are added to a round-bottom flask with pentane and the substrate. Both intercalation methods have shown to be general as intercalation is demonstrated in Bi2Se3, GeS, and other 2D layered nanomaterials. This chemical intercalation provides novel properties for possible energy or catalytic materials applications.

#### Fullerene Metal Coordination and Molecular Surgery

Banann Isbeih Sponsor: Alan Balch, Ph.D. Chemistry

Recent advances in synthetic chemistry have allowed for the possibility to perform molecular surgery and expand upon previous endohedral fullerene research. Molecular surgery enables us to perform C-C bond scission to create and enlarge orifices on the surface of a fullerene, as a precursor to small molecule insertion. Encapsulation after molecular surgery has been observed with smaller covalent compounds like water and formaldehyde. However, due to size, the isolation of platinum and palladium coordinated fullerenes are still being investigated. As per the findings of Murata, M. Murata and K. Komatsu, palladium-fullerene coordination complexes have been isolated and identified. These findings suggest that coordinating another d<sup>10</sup> metal, such as platinum, would be a promising candidate for C<sub>60</sub> derivative, MMK9. MMK9 contains an activated carbon double bond surrounded by two carbonyl moieties, which facilitates metal coordination. It is our goal to synthetically execute these procedures, maximize purification and selectivity, isolate and crystallize these compounds, and characterize and host-quest interactions using X-ray crystallography as well as NMR, IR and UV-Vis spectroscopy.

#### **Differing Ideas of Karma in South Asian Religions**

*Kriti Iyer* Sponsor: Lynna Dhanani, Ph.D. Religious Studies

In popular culture, the word karma is commonly used to convey the idea of "reaping what you sow" and is used rather loosely. One hears the phrases "good karma" and "bad karma" all the time. However, in the South Asian religious context, the meaning of the term and its implication for realizing religious goals are highly contextualized, diverse, and debated. My presentation will focus on the ways in which the South Asian religions of Jainism and Hinduism perceive the accumulation of karma-and for the Jains, it is literally considered a material substance—as well as the most effective ways to eliminate it and achieve liberation from worldly bondage and a state of complete knowledge of the higher Self and the world. I will analyze both Jain scriptures as well as Hindu primary texts written between the fourth century B.C.E. and fifth century C.E. to deduce prominent ideological differences between karmic influx and retribution, and re-consider the role of knowledge in eliminating karma as articulated by both systems. Knowledge is considered an inherent aspect of the soul in both systems, although characterized, as is karma, in remarkably unique ways.

*Kiya Jackson* Sponsor: Joanna Chiu, Ph.D. Entomology/Nematology

Circadian rhythms in animal physiology are dependent on synchronization of external environmental time cues with internal molecular oscillators. CLOCK (CLK) protein is a key component of the Drosophila molecular oscillator. Although phosphorylation has been established to play a central role in regulating protein activity, the mechanisms by which phosphorylation regulates CLK transcriptional activity is largely unknown. We hypothesize that Casein Kinase 1 alpha (Ck1a)dependent phosphorylation of CLK at serine 13 (S13) reduces CLK transcriptional activity by removing it from clock gene promoters. To test this hypothesis, we generated a phosphospecific antibody to confirm CK1a-dependent phosphorylation of CLK(S13) in Drosophila cells. We conducted validation experiments in Drosophila S2 tissue culture cells to confirm the specificity of the CLK(S13) antibody. We performed transient transfection of S2 cells to coexpress clk and ck1a. Specificity of the CLK(S13) antibody is evaluated by immunoprecipitation followed by Western Blotting to determine the phosphorylation status of CLK(S13). Additionally, CRISPR iniections are underway to generate clk(S13A) nonphosphorylatable and clk(S13D) phosphomimetic fly mutants, which will be used to determine how CLK(S13) phosphorylation affects CLK transcriptional activity in vivo. Results of this study will provide a better understanding of how phosphorylation modulates CLK function and regulates animal circadian rhythms.

## Functional Genetics to Analyze Effects of Genes Involved in Drought Tolerance and Seed Composition in *Arabidopsis thaliana* and Maize

Abelina Jackson Sponsor: Christine Diepenbrock, Ph.D. Plant Sciences

Climate change has involved a 20-40% reduction in mean precipitation rates, increased high-temperature stress, and an overall decrease in staple crop viability in portions of Latin America, reducing agricultural productivity with losses reaching \$13 billion. This poses a threat to many rural farmers who rely primarily on subsistence farming as well as the global food markets depending on their exports. The aim of this study is to use functional genetics approaches to examine crop tolerance to drought stress and potential pleiotropic effects on seed nutritive quality. Three genes found in maize, ZmASR3, ZmPYL12, and zmm28, have previously been tested in Arabidopsis thaliana that when overexpressed result in elevated drought tolerance through varying mechanisms. Using the floral dip transformation method and a drydown shared pot experiment of primary transformants, we will measure gravimetric soil water content, transpiration, and stomatal conductance, as well as seed quality traits via AOCC wetchemistry methods for protein, fat and starch content. We will then apply methods and findings of these physiological, biochemical, and molecular characterizations in Arabidopsis in maize as well, to determine the manner and extent to which these genes promote similar patterns of drought tolerance, yield, and nutritive quality response as in Arabidopsis.

### Chiral Organosilicon Compounds as Novel Catalysts and Ligands

### Sarai Jaime Sponsor: Annaliese Franz, Ph.D. Chemistry

Silicon can be found in many organic compounds such as in everyday products ranging from agricultural chemicals to personal care products. Previous work in the Franz group demonstrated that silanol-containing organic catalysts possess unique hydrogen bonding and anion recognition properties; however, reactions to selectively produce chiral-at-silicon center remain limited. This work describes a new approach to creating molecules with stereogenic silicon centers using a bifunctional chiral amide catalyst for a selective silvlation reaction. The goal of this project is to synthesize and evaluate different catalyst analogs by changing the Lewis base part of the catalyst, which we hypothesize to be important for inducing selectivity. The silvlation reaction will be monitored using spectroscopic and kinetic methods to determine the selectivity obtained using each catalyst. In addition, binding studies will be conducted to analyze and compare binding interactions for each catalyst using NMR spectroscopy. The results of these methods and studies will provide insight into the rarely studied reactions to produce molecules with stereogenic silicon and guide incorporation of chiral silanes into chiral ligands and organic catalysts.

## Talking to Babies: Does What You Say Matter?

### Jacklyn Jardel Sponsor: Katharine Graf Estes, Ph.D. Psychology

It seems instinctive for adults to use infant-directed speech (IDS) when speaking to infants-they raise their pitch, slow their speech, and exaggerate their intonation. Acoustic features have shown significant impacts on infant word-learning (Ma et al., 2011), but elaboration may also play a role. While a study has shown that repeating words facilitates word-learning (Maura et al., 2020), elaboration could also be important for language acquisition by exposing infants to the context of words. This study will examine the difference between repetition and elaboration of IDS and its relationship to infants' vocabulary development. Twenty American-English speaking parent-child dvads participated in a set of interactive tasks that contained objects labelled with target words. Audio recordings will be analyzed for the frequencies of target words spoken (e.g. cow) and additional descriptors used per object (e.g. "cows make milk"). We also collected parental reports of infant vocabulary size. We predict that infants whose parents use additional descriptors will have larger vocabularies than infants whose parents use more isolated repetitions of target words. We propose that elaborations are important because it diversifies word exposure. Understanding the role of repetition and elaboration in IDS is important because they may facilitate infant language acquisition.

Jair Jauregui Torres Sponsor: Leopoldo Bernucci, Ph.D. Spanish & Portuguese

This study examines the poem "Soneto Watteau" by the Mexican writer José Juan Tablada. By employing an exquisite language, which assimilates a painted image, Tablada alludes to a well-known artwork, Pilgrimage to Cythera by the 18<sup>th</sup> century painter Jean-Antoine Watteau. The allusions to this painting indicate the use of the ekphrasis, a rhetorical figure in which a vivid description is made of an artwork to replicate it in the mind of the reader. However, Tablada diverts from meticulously representing Watteau's painting; instead, he only references the most distinguishable features from it, such as the author himself and its compositional elements. To fully understand this ekphrastic exercise, a comparison between the two works - the painting and the poem – must be done to distinguish similarities that faithfully replicate the visual components to the text and also their differences, such as the intertextual allusion to a figure who does not belong to the painting, Manon Lescaut from the eponymous novel by Abbé Prévost. With the visual and literary references, Tablada produces an iconotext between Watteau and the seductive female Manon to synthesize from a 19<sup>th</sup> century perspective the gallantry and amorous desires among upper class characters typical of 18<sup>th</sup> century artistic representations.

# Effects of Depression and Anxiety on the Processing of Negative Words Emotions, Language, Attention, Memory

*Laura Jett* Sponsor: Tamara Swaab, Ph.D. Psychology

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

## Modeling Familial Pancreatic Cancer With CRISPR/Cas9 to Develop Personalized Cancer Therapy

### Keely Ji

Sponsor: Changil Hwang, D.V.M.,Ph.D. Microbiology & Molec Genetics

Pancreatic cancer is the third leading cause of cancer-related deaths in the United States. Around 10% of pancreatic cancer cases are categorized as familial pancreatic cancer (FPC) and are associated with germline mutations in genes related to the DNA repair pathway. To develop targeted treatments for these patients, we created models that recapitulate the FPC gene mutations in a murine pancreatic cancer cell line and found that FPC gene deficiency conferred sensitivity to an epigenetic drug called bromodomain inhibitor (e.g., JQ1), which prevents bromodomain and extra-terminal motif proteins from interacting with the acetylated histones. This study aims to elucidate the mechanism of JQ1 drug sensitivity in FPC gene-deficient cells. The analysis of RNA-seq data and Gene Set Enrichment Analysis prompted us to hypothesize that JQ1 induces apoptotic cell death through increasing DNA damage and suppressing DNA repair pathways. To test this, I will perform western blot and indirect immunofluorescence to measure the cellular amounts of DNA damage, repair, and apoptotic proteins upon JQ1 treatment in FPC gene-deficient cells and compare to the JQ1-treated controls. Understanding the mechanism of JQ1 drug sensitivity will provide essential information to strategize effective combination therapy that will synergize with JQ1 to induce synthetic lethality.

# Muscle mitochondrial energetics is associated with muscle performance in chronic kidney disease

Sami Jin Sponsor: Baback Roshanravan, M.D. MED: Int Med Nephrology (sac)

Chronic kidney disease (CKD) affects an estimated 37 million individuals in the United States. Reduced kidney function leads to insulin resistance, metabolic acidosis and retention of uremic toxins contributing to skeletal muscle dysfunction and muscle wasting (sarcopenia). Skeletal muscle dysfunction leads to mobility limitation, loss of functional independence, and vulnerability to disease complications. In CKD, impaired muscle mitochondrial energetics is a major mechanism underlying sarcopenia and impaired mobility. There is an urgent need to identify interventions improving muscle mitochondrial ATP generation and how these improvements translate into muscle and physical functioning. We performed a cross-sectional study nested in a randomized controlled trial of exercise in persons with CKD to determine the association of in vivo muscle mitochondrial energetics with muscle work output from cycle ergometry cardiopulmonary exercise testing. We measured leg muscle mitochondrial capacity (ATPmax) using in vivo 31-Phosphorus Magnetic Resonance Spectroscopy (<sup>31</sup>P MRS) and maximal oxygen consumption (VO2max) and work output from cycle ergometry in patients with moderate to severe CKD. Collectively, our preliminary findings suggest that in vivo energetics of muscle mitochondria in patients with chronic kidney disease is associated with muscle performance and efficiency.

#### *Nicole Johnston* Sponsor: Adrienne Nishina, Ph.D. Human Ecology

Schools act as socialization contexts, in which feeling like one belongs can affect a variety of adolescent life outcomes, such as healthy psychological adjustment and successful relationships. (e.g., McNeely, Nonnemaker, & Blum, 2002). Additionally, body satisfaction beliefs during adolescence are also largely based on socialization within social contexts (Liechty et al., 2016). Therefore, while it is plausible that there is a relationship between adolescents' feelings of school belonging one feels and body satisfaction, little is known about this link. We drew data from a longitudinal quantitative study of twelfth grade adolescents, with data from one school site including 118 adolescents (50% girls; 39% Asian American, 30% White, 11% Multiethnic, 7% Latinx, 6% Other). Results of bivariate correlations indicated that among girls but not boys, a positive sense of school belonging was associated with a myriad of positive body satisfaction indicators, including feeling satisfied with the shape of their body (r = .44, p < .001) and feeling happy about their appearance (r = .42, p < .001). These findings suggest that contexts, such as schools, may play a central role in adolescents' psychosocial well-being. Therefore, schools may be an important context in which body satisfaction interventions could take place.

# Isolation and Characterization of Anaerobic Fungi in the Rumen

*Jillian Jordan* Sponsor: Matthias Hess, Ph.D. Animal Science

Ruminants rely on microbial communities of archaea, bacteria, protozoa, and fungi within the rumen to break down plant biomass into nutrients for the host animal. Anaerobic fungi in particular play a vital role in this fiber degradation by providing enzymatic functions that other microbes cannot. Though important, anaerobic fungi remain understudied due to challenges encountered when trying to isolate and study them in a laboratory setting. By using targeted methods aimed at isolating more of these anaerobic fungi, including media tailored for viable spore formation and carefully monitored anaerobic environments, we can procure an untapped resource within these microorganisms. Growing and isolating these fungi into pure cultures will allow for the DNA amplification and sequencing of the ITS1 region, an established taxonomic marker region to determine the taxonomy (and the novelty) of the obtained isolate. Through enzymatic activity assays on these fungal isolates, we can ascertain the ecological niches of these fungi, further contributing to the known ecological roles of rumen microbes and how they complement one another and the host.

## Using CRISPR-Cas9 to Create Genetic Knockouts for Increasing Meiotic Recombination in Lettuce

### Nina Jorgensen Sponsor: Richard Michelmore, Ph.D. Plant Sciences

Meiotic crossovers play a critical role in generating genetic diversity within populations. Little is known about their regulation in plants, but recently, several anti-crossover genes have been identified, including FIGL1, FANCM, and the RECQ4 helicases. Lettuce (Lactuca sativa) is a popular vegetable in the American diet and has a high economic value. Increasing meiotic crossovers will speed up breeding programs for improving disease resistance, tolerance to environmental stress, and other desirable traits. For this reason, we aim to test whether knockouts of these genes will enhance crossover formation in lettuce. I used Golden Gate cloning to create plasmids encoding Cas9 along with multiple guide RNA's directed toward RECQ4B to increase the likelihood of its disruption after transformation in lettuce plants. While awaiting these transgenic plants, I screened previously generated FANCM, FIGL1, and RECQ4A transgenic plants for editing at different sites in their respective genes. Since the editing efficiency was low in these lines, I am now creating and testing new construct designs to increase the editing efficiency in future experiments.

## Phase I/II Trial of BMS-986205 and Nivolumab as First Line Therapy in Hepatocellular Carcinoma

Anjali Joseph Sponsor: Tianhong Li, M.D.,Ph.D. MED: Int Med Hem/Onc

Hepatocellular carcinoma (HCC) is a frequent cause of cancerrelated death worldwide and incidence of HCC is rising. Sorafenib and lenvatinib are approved for first-line use in unresectable HCC; however, survival benefit remains low for these therapies. Nivolumab, a human monoclonal antibody to programmed death-1 (PD-1) receptor, has been approved as second-line therapy in patients with unresectable HCC refractory to sorafenib. Indoleamine-2,3- dioxygenase 1 (IDO1) is an intracellular enzyme expressed by numerous human malignancies, including HCC, and has been shown to play a central role in immune suppression within the tumor microenvironment. BMS-986205 selectively inhibits IDO1 without activity against another tryptophan degradation enzyme, tryptophan 2,3-dioxygenase. This project aims to evaluate the combination of BMS-986205 with nivolumab 240mg in unresectable and metastatic HCC. Primary objectives are to evaluate safety and tolerability, and to determine efficacy defined by objective response rate. Secondary objectives are to evaluate disease control rate, duration of response, progression free survival, and overall survival. Patients will be followed for 100 days after the last dose of treatment or until all treatmentrelated clinical toxicities resolve to baseline or grade = 1.

### **Increasing Mobility for Leg Amputees**

Megan Jow Sponsor: Jonathon Schofield, Ph.D. Mechanical & Aerospace Engr

As more people work from home during this pandemic, methods for making resources accessible at home have surged. The objective of this project is to provide a leg amputee with a comfortable mode of moving about her home by designing and building a cart. Current market alternatives to a prosthetic leg include: wheelchairs, crutches, and knee scooters. Unlike the bulky features, limited mobility, and low comfort of current devices, our design focuses on providing a comfortable experience for our client while maintaining her mobility. This design has four main parts: the wheel base, the pylon, the socket, and the handle. This design's key features are: a braking mechanism, a working knee joint, a height adjustable handle, and an easily attachable socket. While developing this device, we interviewed our client, assessed our client's needs, researched current market products, and decided on a working design. Once our working design was established, we used concept screening to assess how well our design met our client's needs and researched materials to use for each part of the design. We are creating the CAD models for our device's components. After finishing the CAD, we will begin prototyping and testing our design.

## Night and day: Rate of Affiliative Behavior Depends on Time of day in Novel Pairings of Titi Monkeys (*Plecturocebus cupreus*)

*Karen Kacevas* Sponsor: Karen Bales, Ph.D. Psychology

Coppery titi monkeys (Plecturocebus cupreus) are socially monogamous primates that form long-term attachments to their pair mates. During daytime observations following pairing, new pairs engage in increasing rates of affiliation (i.e., tails intertwined, bodily contact, proximity) across their first week together. Rates of affiliation during the night have never been studied, but titi monkey pairs typically sleep in contact with their tails intertwined. In order to understand how rates of affiliation differ based on time of day and time spent together, we studied 10 newly-formed adult titi pairs across their first week together. Overall, new pairs spent significantly more time in affiliative contact at night compared to during the day (t = 6.78, p < .001). Even on their first night together, new pairs spent an average of 76% of their time in contact, while they spent only 35% of their time in contact during the day. Rate of affiliation increased across the first week post-pairing at night (t = 7.03, p = .002), but not during the day (t = 0.12, p > .05). These results may indicate that nighttime affiliation has additional benefits in comparison to daytime affiliation, such as postural balance or thermoregulation.

#### Lupgist: An Interactive Commenting System for Code Gists

*Arjun Kahlon* Sponsor: Joel Porquet, Ph.D. Engr Computer Science

In typical programming blogs, Github "gists" have become one of the preferred ways for tech writers to showcase snippets of code in their articles. Unfortunately, the code is always shown to visitors in a read-only way, with no possibility of interaction. Our proposed project, Lupgist, aims to develop a lightweight embeddable commenting system that allows visitors to directly comment on the code displayed in a gist. This way, visitors can give precise feedback on certain lines of code, or ask specific questions on areas of confusion. Such pursuit would foster a more integrated discussion for shared code, as well as contribute to making Computer Science more accessible for all. The first prototype of Lupgist is currently being developed as a self-hosting full-stack web application. It will include useful features, such as anonymous commenting, ratings, and moderation. As development continues, Lupgist will stay open source with hopes to become a powerful platform for online authors.

## The Role of Digital Media on College Students' Future Career Beliefs

*Elise Kam* Sponsor: Adrienne Nishina, Ph.D. Human Ecology

As students were forced to spend months at home during the COVID-19 lockdowns, digital media has played an increasingly prominent role in their lives. With racial tensions rising, many may be exposed to racial discrimination online. These negative experiences may shape college students' expectations of future social environments. Drawing on data from a longitudinal study following college students, this study examines the relationship between exposure to negative representations of one's ethnicity/race in digital media and their perceptions of their future career environment. Participants were 227 college students (33% White, 30% Asian, 12% Latinx, 10% Multiethnic, 9% Other). Analysis of bivariate correlations found that being exposed to untrue statements about your ethnic/racial group on digital media is positively associated with expecting to be treated differently in your career because of your ethnicity/race (r = .16, p = .02), expecting to experience difficulty getting hired because of your ethnicity/race (r = .25, p < .001), and expecting to experience ethnic/racial discrimination in your career (r = .16, p = .02). These findings highlight how exposure to racist digital media can lead to expectations of discrimination in one's future workplace environment. Future analyses will consider multiple time points and disaggregate findings across ethnic-racial groups.

*Elya Kandahari* Sponsor: David Olson, Ph.D. Chemistry

Recently, our lab discovered that certain structural analogs of ibogaine, an indole alkaloid originally isolated from a West African shrub, are exceptionally potent neural plasticitypromoting compounds that show potential to alleviate depression, anxiety and addiction. Access to useful quantities of ibogaine in the past has relied on isolation from natural sources; however, this method of isolation is inefficient and environmentally taxing. Thus, the development of an efficient total synthesis of ibogaine is necessary to access sufficient quantities of this molecule for further biological testing. Despite notable advances in chemical synthesis, reliable methods for the construction of ibogaine are lacking, as previous syntheses are severely hindered by high step counts and low yields. Here, we propose a concise 4 step strategy for total synthesis of ibogaine. The synthesis involves a cascading sequence to assemble the tricyclic ring system of the ibogaine molecule from readily accessible building blocks. Preliminary data suggests that the desired product was achieved.

# Structural Elucidation of Fibers in Various Soy-Products

#### Akshaya Karthikeyan Sponsor: Carlito Lebrilla, Ph.D. Chemistry

With the rise of environmentally conscious diets, soy products have become one of the most popular alternatives to their dairy counterparts. Soy is consumed in various forms including soy milk, tofu, miso, and flour. While the total dietary fiber content of these products is known, the specific carbohydrate structures present are still poorly understood. Structural elucidation of these is imperative to understanding the effects they have on health through their interaction with the gut microbiota. Preliminary work shows that the processing methods used to obtain these products from soybeans alter the and, monosaccharide composition thus. the fibers present significantly. To study the changes in fiber structure, the monosaccharide and glycosidic linkage compositions of soybean products will be determined by permethylation with NaOH and iodomethane in DMSO, acid hydrolysis, derivatization 3-methyl-1-phenyl-2-pyrazoline-5-one, with and UPLC-QqQ analysis. Further work involving intestinal microbiota studies can be performed to investigate the correlation between food processing and the gut microbiome. Together, this work will further our understanding of how food processing impacts specific dietary fiber structures and its potential health consequences.

### Introductions to Gender Equity and Intersectional Feminist Discourse

#### *Gursimran Kaur* Sponsor: Rana Jaleel, Ph.D. Gendersexuality Womensstudies

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

## Flaviviruses and the Proviral Effect of PAF1 Antagonism

# Matthew Kenaston

Sponsor: Priya Shah, Ph.D. Chemical Engineering

As a known regulator of RNA polymerase II transcription, Polymerase-Associated Factor 1 (PAF1) is poised to modulate innate immunity through upstream regulation. PAF1 interacts with flavivirus non-structural protein 5 (NS5), a pivotal player in immune evasion. Yet, the immune pathways NS5 disrupts via its interaction with PAF1 remain unidentified. To address these unknowns, we developed CRISPR-Cas9 knockouts of PAF1 along with STAT2, a well-studied target of NS5 antagonism. Our transcriptomic analysis indicates PAF1 promotes a subset of immune genes independent of STAT2. Beyond this, we further identify potential PAF1-mediated restriction of proviral genes detected across multiple flaviviral screens. Via cellular fractionation, we also find PAF1 to accumulate in membranebound organelles more so during infection, suggesting another layer of disruption benefiting viral pathogenesis. PAF1 antagonism could, evidently, provide numerous gains to flaviviruses, highlighting the likely evolutionary advantage derived from the NS5-PAF1 interaction. Understanding these viral mechanisms is particularly vital as the global population faces a growing risk to flaviviruses and the need for effective treatments becomes even more relevant.

*Moanam Khalid* Sponsor: Prabhu Shankar, M.D. MED: Public Health Sciences

The ongoing COVID-19 pandemic has plagued Yolo County and Sacramento over the past year. As recommended by the Center for Disease Control, an understanding of the symptoms of the disease is necessary to take control measures and prevent the spread of the infection. The majority of the mainstream information about COVID-19 symptoms only available in the English language and families with Limited English Proficiency (LEP) are left at a disadvantage. Creating a multilingual platform can increase the accuracy of symptom capture through the translation of healthydavistogether.com COVID-19 symptom tracking and important information about vaccination. The project information will be translated into the popular languages spoken in Yolo County which will be compiled both into a digital library, as well as into a pamphlet in English and other most commonly spoken languages. The symptoms will be depicted with images and checkboxes. The commonly used representations of the disease manifestations will be mapped to the currently used English terms, as well as SNOMED-CT vocabulary. If successfully implemented and maintained, this project will increase awareness, data accuracy, strengthen research, and encourage LEP population participation in COVID-19 public health preventative measures. The model could be generalizable to any future threats by illnesses to public health.

# What are the Roles of Pitch Variation and Word Repetition in Infant Vocabulary Development?

### *Divya Khanna* Sponsor: Katharine Graf Estes, Ph.D. Psychology

Infant-Directed Speech (IDS), also known as baby-talk, is characterized by higher pitch, longer word duration, a wider pitch range, and more word repetition in comparison to Adult-Directed Speech (ADS). Prior research suggests that components of IDS affect infants' language learning. However, we do not yet know how certain linguistic elements, such as varying pitch and word repetition, contribute to infants' vocabulary development. The current study will investigate whether infant vocabulary size correlates with parents' pitch range and/or the number of target word repetitions the parent produces. We will analyze audio recordings of monolingual English-speaking parents playing with their infants (n= 24, ages: 10-12 months) in a task designed to elicit 14 target words (e.g., hat, apple, boat). We will count repetitions of each target word and measure the pitch range for these target words for each participant. We will collect infant vocabulary size via parental reports on a standardized vocabulary form. We expect that parents with high rates of target word repetition and wide pitch ranges will have infants with the largest vocabularies. If confirmed, these findings would suggest that certain characteristics of IDS can be targeted to promote better linguistic development in infants.

## From Bitter to Sweet: Affection and Insults in Punjabi Folk-Songs

#### Husn Kharabanda Sponsor: Eric Iouis Russell, Ph.D. French & Italian

Cultural variations in the expected manner of expressing emotions make folk translations complicated. In Punjabi culture, traditionally insulting statements may situationally transform into gestures of affection. This is most noticeable in Sithniyan (singular: Sithni), which are an insult-based variety of Punjabi folk-song that are viewed as gestures of intimacy and affection. To the outside observer, direct translations of Sithniyan may appear to violate all expectations of politeness expected in Eurocentric societies. This paper investigates the social environments that make Sithniyan acceptable and the boundaries they observe. It looks at the rules governing insults in Punjabi culture and explains why some insults are acceptable in folk-song but not in conversations. Compared to other folk songs, Sithniyan are less personal, mentioning no names or true grievances and focussing instead on the comically outrageous, allowing them to include more traditionally offensive terms. They are sung only during pre-wedding ceremonies as opposed to being a part of everyday life, allowing the freedom of using insults to become a form of celebration and de-stressing. Understanding the place Sithniyan hold in Punjabi culture allows them to be understood as the unique expression of cultural identity that they are; a step towards bridging one more cultural gap.

## Biodiversity: Exploring the Genetic Factors in Species Invasions

#### Matthew Kim Sponsor: Sebastian Schreiber, Ph.D. Evolution & Ecology

Invasive species are a top ecological problem, and understanding what factors reduce their likelihood for success is critical in improving conservation efforts. Previous studies suggest a successful invasion can depend on the biodiversity of the invaded community. In theory, more diverse communities are more resistant to invasion, possibly due to fewer open ecological niches. This study tested whether the composition of the invaded (resident) community affected invasion success. We used a genotype of water flea, Daphnia, to serve as the invader, and invaded either a rival Daphnia genotype or another zooplankton community. We expected that invasion success would be lower against the rival Daphnia because genotypes of the same species would share similar ecological niches. Interestingly, preliminary findings indicate that neither genotype of invading Daphnia were successful in colonizing the fully established community of other zooplankton, but were able to invade each other. Further research should look into the role of Simocephalis, a fierce competitor of Daphnia, and how their inclusion in the zooplankton community may have contributed to such invasion results.

#### Hanna Kim Sponsor: Ozcan Gulacar, Ph.D. Chemistry

Questions in assignments for students are often grouped by chapter, topic, or concepts. The structure shows a great emphasis on categorization. Practice problems in chemistry textbooks are mostly organized by sections to help students navigate the assignments and practice in order; however, exams usually test students with problems from a series of chapters in a mixed format. Therefore, there is a mismatch between what students practice on and how they are tested. The goal of this study is to examine the structure of the assignments on students' problem-solving performances. The study uses scientific control method and divides students into two groups throughout three experiment sessions. Each group had interventions with same length and identical questions but different structures. The experimental group had mixed questions, while the control group had questions organized based on chapters and topics. This study is critical in studying students' learning abilities with mixed and categorized problems. The findings could help UC Davis instructors to better structure their teaching materials to help improve students' problem-solving abilities. Given most textbooks and instructors tend to organize and classify content for students to navigate the knowledge base, this study is important to assess the effectiveness of the traditional teaching method.

## Coming Full Circle: The Ideational Parallels of Catherine Beecher and the De Stijl Art Movement

Kayetana Klinghoffer Sponsor: Diana Strazdes, Ph.D. Art & Art History

Considerable energy has been put into the research of floor plans for Catharine Beecher's "A Christian House," and the De Stijl inspired "Schröder House" by Gerrit Rietveld. The sustained level of interest is due to their enduring influence on 21stcentury design and building practices. Scholars have mainly focused their energy on the architect's personal agendas, their ideologies, and, finally, their overall intention emphasized by attention to furniture arraignment, color, and decoration. Regardless of the substantial effort put into these studies, I found no scholastic attempt comparing the two. This oversight is predictable but shortsighted. The insular nature of the scholar's focus is understandable given the considerable interval of time between subjects, the obvious polarity of the architect's personal principles, and oppositional aesthetic canons. In my paper, I was able to do what no other scholar has done, draw solid parallels between Beecher's and Rietveld's house plans based on ideational and stylistic tenets. Such as economic practicality including the dismissal of elitists behaviors like frivolity and excess, and the additional goal of constructing a wholesome residence where family and intellectual growth were paramount.

#### **Optimization of Exosome Transfection in ARPE-19**

**Reshma Kolala** Sponsor: Zeljka Smit Mcbride, Ph.D. MED: Eye Center

Diabetic Retinopathy (DR) is an ocular disorder characterized by microvascular changes in the eye. Our lab has previously identified a set of microRNAs (miRNAs) dysregulated in DR patients' ocular fluids. miRNAs are small non-coding RNAs that may play a role in DR pathogenesis and can be packaged in exosomes, natural carrier and delivery vehicles. The long-term goal is to develop miRNA-based early biomarkers and therapies for DR. The short-term goal was to optimize the transfection rate of a human retinal pigment epithelium (ARPE-19) cell line by exosomes and determine which cellular labeling is most effective. The concentrations of exosomes and the incubation period of transfected ARPE-19 were varied to determine which conditions allow for the highest transfection rate. We used two sources: mesenchymal stem cells (MSC) exosomes labeled using ExoGlow (red-fluorescent dye) or HEK-293 exosomes X-Pack GFP-loaded (green-fluorescent protein). ARPE-19 were labeled using an Oregon Green Phalloidin or CellTrace calcein red/orange AM and were imaged using an Olympus FV3000 confocal and ImageXpress XL high-content microscopes. Results indicate that the highest transfection rate was achieved when 0.23ug of exosomes were added to 10,000 ARPE-19 cells after a 5-hour incubation period.

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

*Kendal Koorenny* Sponsor: Alison Bright, Ph.D. University Writing Program

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

# What are the Roles of Pitch Variation and Word Repetition in Infant Vocabulary Development?

*Miranda Kramer* Sponsor: Katharine Graf Estes, Ph.D. Psychology

Infant-Directed Speech (IDS), also known as baby-talk, is characterized by higher pitch, longer word duration, a wider pitch range, and more word repetition in comparison to Adult-Directed Speech (ADS). Prior research suggests that components of IDS affect infants' language learning. However, we do not yet know how certain linguistic elements, such as varying pitch and word repetition, contribute to infants' vocabulary development. The current study will investigate whether infant vocabulary size correlates with parents' pitch range and/or the number of target word repetitions the parent produces. We will analyze audio recordings of monolingual English-speaking parents playing with their infants (n= 24, ages: 10-12 months) in a task designed to elicit 14 target words (e.g., hat, apple, boat). We will count repetitions of each target word and measure the pitch range for these target words for each participant. We will collect infant vocabulary size via parental reports on a standardized vocabulary form. We expect that parents with high rates of target word repetition and wide pitch ranges will have infants with the largest vocabularies. If confirmed, these findings would suggest that certain characteristics of IDS can be targeted to promote better linguistic development in infants.

## Developing a Vascularized Lung Model to Observe the Effects of Inflammatory Cytokines on Endothelial/Epithelial Barrier Integrity

*Matangi Kumar* Sponsor: Megan Dennis, Ph.D. MED: Biochem & Molecular Med

Surfactant Protein B (SPB) is essential for lung function by decreasing the surface tension and preventing alveolar lung collapse which results in acute respiratory distress syndrome(ARDS). Interestingly, murine studies have shown surfactant production declines with age, but there are few studies looking at this phenomenon in humans. Also, it is known that lung-age related diseases are often exacerbated by increased levels of inflammatory cytokines.

Here we investigate the effects of inflammatory cytokines TGF? , IL-13 and JUUL concentrate on epithelial and endothelial lung barrier integrity using our in vitro vascularized lung model.

Transepithelial/endothelial electrical resistance(TEER) was used to measure the integrity of tight junction dynamics in cell culture models. TEER results showed TGF? increased electrical resistance of the epithelial and endothelial barrier, whereas JUUL concentrate showed decreased electrical resistance of the epithelial and endothelial barrier. We show this vascularized model is capable of measuring the effects of inflammatory cytokines on lung barrier integrity, future experiments will utilize SPB mutant and rescue cell lines to investigate how surfactant deficiency exacerbates the symptoms of ARDS in this in vitro vascularized lung system.

#### Serena Kutney Sponsor: Annaliese Franz, Ph.D. Chemistry

Oleaginous microalgae produce lipids that can be used as a feedstock for sustainable biofuels. Inhibitory factors such as the high cost of cultivation and harvesting are why microalgae biofuels are not yet an affordable alternative energy resource. Cultivating microalgae on the ultra-filtered effluent of anaerobically digested food waste permeate (FWP) has the benefit of providing a cost-effective media rich in essential nutrients. Previous literature reports demonstrated an increase in lipid production when cultivating microalgae in salt-stressed environments. Given the results of these studies, I hypothesize that the cultivation of microalgae in FWP supplemented with salt will induce metabolic changes in the microalgae necessary for their survival in the extreme environment of wastewater, thus increasing lipid productivity. In this study, 10% FWP effluent was supplemented with different concentrations of magnesium and sodium chloride. Initial data indicates an increase in biomass productivity and pigment content when supplementing with high quantities of salts. Neutral lipid content for both salt supplementation methods will be presented and compared. The overall goal of these salt supplementation studies is to optimize microalgae growth on FWP, to contribute to the body of research focusing on wastewater remediation, and in the process, make microalgae products more economically feasible.

## From South Central to Black Lightning and Everything In-Between : The Representation and Engagement Offered Through Mara Brock Akil's Projects.

*Kyerah Kyles* Sponsor: Elisa White, M.A. African American African Stds

Acclaimed writer, producer, and creator Mara Brock Akil has been involved in a number of projects that have put Black actors and stories on television for a wide audience to enjoy. Starting in 1994 with being a writer on the series South Central, Akil has created a career for herself that has allowed her to create multiple popular series - The Game, Girlfriends, and Being Mary Jane - to being involved as a screenwriter and producer on other series like Black Lightning and Moesha. In her nearly three decades long career, Akil has created shows that were once before thought impossible to make. In doing this, she has created a network of people that actively engage with her projects because of the representation she offers and the relatability of her characters. The influence of her work has crossed generations and this will be measured by studying interactions across platforms like podcasts and social media, as well as conducting focus groups to better understand how Black Americans emotionally engage with her work. This study will offer more insight as to how Black Americans engage with others who have seen Akil's work as well as how they internalize what they see in her projects.

## Force-induced Cten Interactions Surrounding the Keratin Network

*Tzu Wei Lai* Sponsor: Soichiro Yamada, Ph.D. Biomedical Engineering

Epithelial tissues serve as an important protective structure. Our current project focuses on keratin 8 (k8) and keratin 18 (k18) since they are the primary intermediate filaments of simple epithelia. The keratin network provides mechanical integrity of epithelial tissues, and it is suggested that the keratin may serve as the force-sensing element in cells. Yet, the current understanding of keratin mechano-biology is very limited. Our lab has previously discovered that cten, a protein known to act as both tumor suppressor and promoter, accumulates around force-bearing keratin fibers in vivo. My goal is to define the specific force-induced protein-protein interactions surrounding the keratin network in vitro. Using a microneedle to stretch keratin filaments then adding purified cten, we observed that cten accumulated along stretched keratin filaments. This indicates the cten binds keratin filaments directly in a forcedependent manner. We will further define the minimal forcesensitive sequence of cten and the role of this unique protein interaction between keratin and cten in the context of cancer.

## Pandemic Homeschooling:

## How Will This Impact Children?

*Tamyia Landers* Sponsor: Jacob Hibel, Ph.D. Sociology

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

### A Meta-analysis of Hospital Acquired *Ralstonia spp.* Infections and Their Trends

## Grace Lankford Sponsor: Tiffany Lowe-Power, Ph.D. Plant Pathology

Ralstonia spp. are gram-negative, opportunistic bacteria in the Burkholderiaceae family that have been linked to hospitalacquired, otherwise known as nosocomial, infections. The aim of this study is to examine the frequency and effects of nosocomial Ralstonia spp. infections in patients with pre-existing conditions and compromised immune systems. I am currently examining literature and compiling data points of case studies and outbreaks of Ralstonia spp. in order to identify patterns of infection sources and pre-existing conditions that make individuals more susceptible to infection by Ralstonia spp. Thus far, the data from 21 papers suggest that certain pre-existing conditions such as cystic fibrosis, crohn's disease, and type 2 diabetes mellitus make patients more susceptible to infection. Most commonly, infection by Ralstonia spp. leads to bacteremia, sepsis, and bloodstream infections. These infections and resulting ailments often prove fatal to highly immunocompromised individuals. They are likely caused by contaminated oxygen delivery systems, central venous catheters, implanted devices, and saline solutions. Most pathogen isolates are identified as members of the polyphyletic species R. pickettii, but other cases and outbreaks have been attributed to R. mannitolytica, R. insidiosa, and R. solanacearum. Work is ongoing to contextualize isolates within the known Ralstonia species using reported DNA sequences.

# Synthesis of Merocyanine-type Photoacids and Analysis Using NMR Spectroscopy

*Emmanuel Lanuza* Sponsor: Annaliese Franz, Ph.D. Chemistry

This project consists of using NMR Spectroscopy to analyze the isomerization and acidity of merocyanine-type photoacids. These photoacids exhibit a cis-trans isomerization when excited by light of the appropriate wavelength that changes the structure from an open to a closed spyropyran form with enhanced acidity. This unique feature of the merocyanine-type photoacids allows for the study of effects of the interaction of acidity with these photoactive compounds. This isomerization can be measured using <sup>1</sup>H and <sup>31</sup>P NMR spectroscopy. We also propose that acidity can be measured using a Lewis basic probe TEPO (triethyl phosphine oxide) that interacts via hydrogen bonding or protonation in solution. The purpose of this project is to synthesize and compare the structure, isomerization and acidity of merocyanine-type photoacids in various solvents and determine if acidity can be measured using TEPO as a probe. This is useful for an efficient method to determine acidity of a photoactive compound and study electronic and structural features of photoacids.

*Giovanni Lara* Sponsor: Roland Faller, Ph.D. Engineering Deans Office

The novel coronavirus SARS-CoV-2, which causes the COVID-19 disease, has created mass lockdowns world-wide due to its high transmission rate and lethal nature. It is well documented that the SARS-CoV-2 spike glycoprotein interacts with human receptor ACE2 in order to enter cells to start replication. Recent research<sup>[1]</sup> suggests that the glycosaminoglycan heparin which is also present in most mammalian cells may be able to bind to the SARS-CoV-2 spike glycoprotein, explaining observed lower transduction efficiency in cell culture when high amounts of heparin is present. To validate this interaction, a SARS-CoV-2 spike glycoprotein fragment and heparin are tested in silico to find binding affinity by measuring the relative distances between the molecules at various time points. Hydrogen bonding interactions between the two molecules are also mapped for better understanding of the interaction. High binding affinity may reveal potential in heparin and its derivatives as drugs to reduce transfection rates of SARS-CoV-2.

[1] R. Tandon et al. biorxiv doi.org/10.1101/2020.06.08.140236.

# Environmental Burden and Incarceration at a Crossroads: A Quantitative Analysis of Incarceration Rates and Environmental Quality in the State of Georgia

Alexandra Larman Sponsor: Clare Cannon, Ph.D. Human Ecology

Intersectional environmental and incarceration justice data tools (ex. VERA, EJ SCREEN) highlight the intersection of these issues with economic and social indicators. We seek to understand the relationship between countywide incarceration rates and environmental quality using Georgia counties as a case study. Georgia state suffers from disproportionally high levels of incarceration nationwide (PPI). Using data from the VERA Institute of Justice (2014) and the US Environmental Protection Agency Environmental Quality Index (2013), we employed bivariate correlation and OLS regression to analyze the between county association incarceration rate and environmental quality compared to individual-level sociodemographic, behavioral, and socioeconomic characteristics. We found that environmental quality was most associated with incarceration rate (95% Confidence Interval [CI]= Beta .47), while all other variables also had a significant relationship. Among Georgia counties for which there are data (n = 157), the association between county incarceration rate and environmental quality (determined by US EPA environmental quality index) may be explained by existing sociodemographic disparities and complex environmental justice issues. Policymakers should consider the intersection between incarceration and the environment when shaping incarceration and environmental policy. Future research should include a qualitative analysis of communities at the intersection of incarceration and environment quality.

#### Effect of Electrolyte on Aggregation and Bifurcation of Colloidal Particles near Electrodes Under AC Electric Fields

## Joshua Lau Sponsor: William Ristenpart, Ph.D. Chemical Engineering

Colloidal particles close to electrode surfaces under applied ac fields have been observed to either aggregate or separate laterally based on the identity of electrolyte solution. To date, there is no consensus on what role the electrolyte identity plays in determining the behavior of the colloidal particles. We propose that Asymmetric Rectified Electric Fields (AREFs), steady electric fields resulting from differences in electrolyte ion mobility, may make significant contributions to the overall fluid flow pattern in the system. Here, we use confocal fluorescent microscopy to analyze aggregation rate and height above the electrode for seven electrolyte solutions under three ac field amplitudes and three ac field frequencies. We model the aggregation of particles as a second order reaction and calculate a characteristic aggregation constant for each electrolyte and ac field setting. Finally, we demonstrate that the predicted AREF strength near the particle is correlated with the observed particle aggregation behavior.

## The Effect of Air Pollution on Voter Turnout

## Katherine Laursen Sponsor: Giovanni Peri, Ph.D. Economics

The United States consistently has low voter turnout rates compared to other countries, and there are a wide variety of reasons that contribute to these low turnout rates. Voting could be made much easier by expanding mail-in voting and early voting as alternatives to going to a polling place on a Tuesday in November and waiting in line. Would voter turnout increase if alternative methods of voting are more widely accessible? My thesis investigates the effect of environmental circumstances, specifically air pollution, on voter turnout. This topic combines two main interests of mine, which are 1) how to increase voter turnout in the US, and 2) what are the social impacts of climate change? Past studies have linked rainy election days to lead to a decrease in voter turnout, and there is a general consensus that lower voter turnout tends to favor Republican candidates. I investigate if air pollution leads to fewer people voting on election day to avoid exposure to bad air while waiting in line. Furthermore, if turnout decreases as a result of these weather events, which voters are more impacted and does either party benefit?

# Characterization of Defensin Protein Usage by Myxococcales During Development and Hunting

Bryant Law Sponsor: Mitchell Singer, Ph.D. Microbiology & Molec Genetics

Myxococcales are unusual amongst prokaryotes for their expression of defensin proteins, which were previously only known to be expressed in Eukaryotes as an antimicrobial. With an incomplete understanding of the role defensins play in humans, our lab studies the use of defensin in Myxococcales' development and hunting to extrapolate the usage of the protein for both Myxococcales and humans. Finding characteristic defensin-like cystine patterns in several Myxococcales, our lab attempted to elicit the function and expression of defensins in M. fulvus B02, M. macrosporus HW-1, and M. xanthus DK1622 based on RNA seq. After filtering data and molecular modeling of hypothetical, orf, putative, uncharacterized, unnamed, defense and defensin characterized proteins from the NCBI non-redundant reference sequence database, we selected four defensin genes. Each gene was examined using knockout mutations via electroporation of the vector plasmid pBJ114 and cloning with E. coli DH5a. We also assessed the usage of defensin as a tool for hunting with P. carotovorum JL1134, P. syringae pathovar alisalensis, S. marcescens ATCC 39006, S. suberifaciens CAI, and X. campestris pathovar vitians BS339.

## Quantification of the Effect of Oxidation-Dependent Autonomous Activation of CaMKIId on Arrhythmogenic Calcium Mishandling in Cardiomyocytes

Leann Le Sponsor: Donald Bers, Ph.D. MED: Pharmacology

Calcium-calmodulin dependent protein kinase IId (CaMKIId) regulates numerous functions in the cardiomvocvte, including cycling, calcium transcription. and contraction. Autophosphorylation at T287 prolongs CaMKIId activity (autonomous activation) which persists even after Ca/CaM dissociates. This prolongation is associated with pathologies such as heart failure and arrhythmias. Oxidation at MM281/282, among other newly discovered post-translational modifications, was found to autonomously activate CaMKIId in similar mechanistic fashion. However, little is known about the extent to which these post-translational modifications affect calcium release in cardiomyocytes. Here, we investigate the degree to which autonomous activation of CaMKIId by oxidation at MM281/282 affects intracellular calcium handling, relative to the effects of a persistently active phosphomimetic mutant variant (T287D) of CaMKIId. Using confocal linescan imaging approaches, we compared calcium transient morphologies, SR calcium content, and calcium waves generated in paced intact rabbit ventricular myocytes loaded with Rhod-2, a calciumsensitive dye, between wild-type and T287D myocytes before and after exposure to oxidative stress (100  $\mu$ M H<sub>2</sub>O<sub>2</sub>). We found that oxidized CaMKIId intensifies calcium mishandling relative to control, especially for the T287D variant. We expect that these findings will yield greater insight on how CaMKIId oxidation contributes to cardiac arrhythmia development and on potential clinical strategies for its prevention.

### Access to Highly Effective Reversible Contraception at Family Planning Clinics in California

Kathy Le

Sponsor: Eleanor Schwarz, M.D. MED: Int Med - Genl Medicine

Subdermal and intrauterine contraceptives are safer and more effective than birth control pills. California's Family Planning, Access, Care, and Treatment (FPACT) program offers free contraceptive services to individuals living at or below 200% of the federal poverty level. To assess the proportion of FPACT clinics currently providing intrauterine and/or subdermal contraceptives, we performed a "secret shopper" study of a 20% random sample, stratified by county. Of the 2,200 clinics listed on the FPACT website, located in 53 counties, we aimed to contact 325, and successfully collected data from 183. Most (61%) clinics reported offering both subdermal and intrauterine contraceptives, 9% only offered intrauterine contraceptives (IUC), and 2% only offered subdermal implants; 18% did not offer either, and 10% had staff that were uncertain of the contraceptives offered. Among clinics offering IUC, 3% only offered hormonal IUC and 36% offered both copper and hormonal IUC; 61% offered IUC but were unsure of the type. These findings indicate that a considerable number of family planning clinics in California are not currently providing the safest and most effective contraceptives. Further training of clinic staff is needed to ensure that all Californian families have access to the full range of contraceptive methods.

# Genetic Pathways that Confer *Ralstonia* Survival in Starvation Mode

Hang Le Sponsor: Tiffany Lowe-Power, Ph.D. Plant Pathology

A genus of beta-proteobacteria, Ralstonia consists of three phytopathogenic species that causes severe wilting diseases in many agricultural crops globally. It has been found that Ralstonia cells can survive for long periods of time in a nutrientlimited environment in water reservoirs, including irrigation water and natural water sources. Currently, little is known about the biological mechanisms that support this ability. By creating multiple microcosms of three diverse Ralstonia strains (R. solanacearum IBSBF1503, R. pseudosolanacearum GMI1000, and R. syzygii PSI07) in water, we are able to take samples of different strains of Ralstonia at various time intervals and use Randomly Barcoded Transposon sequencing (RB-Tnseq) to determine which genes confer fitness during starvation conditions in water. Understanding these biological mechanisms has important implications for growing Ralstonia-susceptible crops in infected, and thus unusable, soil, including potential new methods for preventing Ralstonia infections in susceptible crops and enabling once infested lands to be used again for growing susceptible crops.

*Kyla Leacox* Sponsor: Jiandi Wan, Ph.D. Chemical Engineering

There is an increasing interest among researchers to engineer more complex intestinal epithelial tissue constructs for various disease and drug delivery research applications. The main roadblock is the limited number of biomaterials with both the mechanical integrity and cellular compatibility required to sustain the growth of these cells. Considering a proposed strategy of combining hydrogels to mitigate this limitation, we seek to characterize the growth of intestinal organoids in multigel systems. We introduced a Matrigel layer with suspended mouse intestinal stem cells on top of a previously gelled agarose laver of varving thickness and composition. We found that both thickness and composition impacted cell growth, with the thickest (3 mm) and most concentrated (2x PBS) agarose layer having the most detrimental effect on the expansion of intestinal organoids. When a Transwell system was employed, the inclusion of an agarose base layer enhanced the speed of cell growth and induced an elongated morphology in the intestinal epithelial organoids. These results indicate that the existence of an agarose layer and its configuration influence the dynamics of an in vitro intestinal model, which was further investigated by studying the transport characteristics of various gel configurations.

# Cyclases are Essential Regulators of the *Myxococcus xanthus* Development Cycle

*Kayleen Lederman* Sponsor: Mitchell Singer, Ph.D. Microbiology & Molec Genetics

Myxococcus xanthus is a gram-negative soil bacterium that is unique in its ability to aggregate into multicellular fruiting bodies when cells sense limited nutrients. In a previous study, it was shown that mrpC, a cyclic nucleotide binding protein, is an essential transcriptional regulator of the M. xanthus developmental cycle. Cyclases are activating enzymes that catalyze the formation of cyclic adenosine monophosphate (cAMP) and cyclic guanosine monophosphate (cGMP), two important cellular signaling molecules which activate mrpC. M. xanthus has 13 putative cyclase genes that our lab has shown to be active during fruiting body formation based on RNAseq analysis. Therefore, I hypothesize that at least one cyclase gene is essential for normal fruiting body formation in M. xanthus. I am creating knockout mutations of each cyclase gene in M. xanthus and testing for changes in developmental phenotypes compared to the wildtype. Plating of two different cyclase mutants on nutrient absent TPM agar shows that they produce smaller fruiting bodies compared to the wildtype. This suggests that the fruiting bodies produced by these cyclase mutants are not reaching full maturity, supporting my hypothesis and indicating that these two cyclases are essential for normal fruiting body formation.

#### **Body Satisfaction and Social Eating Among Adolescents**

*Elizabeth Lee* Sponsor: Adrienne Nishina, Ph.D. Human Ecology

Adolescents tend to focus on their body appearance as they grow older. During this time, friendships are also at the forefront of youth's minds, as they navigate their personal and social identities. However, little is known about how adolescents' body satisfaction beliefs relate to their social interactions, particularly during food-related gatherings like lunch-time. In the current study, we drew data from a longitudinal quantitative study with 116 twelfth grade adolescents in California (52% girls; 39% Asian American, 32% White, 11% multiethnic, 8% Latinx, 4% Other). Preliminary findings indicate that girls' were less likely to eat lunch with friends when they felt dissatisfied with the shape of their bodies (r = -.29, p =.03). In addition, among students who were dissatisfied with the shape of parts of their bodies, boys were more likely to have lunch with friends in person (r = .27, p = .04), while girls were more likely to have lunch with friends electronically (r = .306, p =.03). Final analyses will include data from additional school sites and examine results across ethnic-racial groups. Thus far, the results suggest that school interventions addressing students' body satisfaction beliefs could promote social eating for girls.

#### **Religious Body Symbolism and Sexuality**

*Maya Lee* Sponsor: Naomi Janowitz, Ph.D. Religious Studies

Throughout history, religions have intended to create and maintain order for the good of society. This order was widely achieved through cultural norms surrounding what the "ideal" man and woman ought to be. This manifested in symbolic forms such as gender roles, gender-specific occupations, and more specifically, what society deemed as "appropriate" sexual behavior. Many religions draw a symbolic connection between virginity, especially female virginity, and the wholeness or purity of a people. Mary Douglas argues that in the symbolism of a body, all bodily fluids and imperfections can potentially be equated to a threat to society. Her theory raises an interesting question as to why unmarried women and men are viewed differently in regard to societal threats. My research will investigate the role of body symbolism in religious texts, contrasting the various symbolic representations of sexuality in patriarchal, matriarchal, one-gender, two-gender, and multigendered religions. I hypothesize that body symbolism will be prevalent in both multi-gendered and single-gendered religions with key differences such as abundance and societal purity surrounding sexuality.

*Jingyanshan Li* Sponsor: John Yoder, Ph.D. Plant Sciences

Root parasitic plants in the family Orobanchaceae can be devastating agricultural weeds. Our research is directed toward developing a genetic based strategy to control these pests. We use Triphysaria versicolor as a model parasite for this family because it is non-weedy, easy to work with, and amenable to molecular genetic studies. Parasitic plants rely on an organ known as a haustorium to attach, invade, and acquire resources from host plants. We have identified eight genes with predicted functions in haustorium development. To investigate the role these genes play in haustorium development, we are using the genome-editing tool CRISPR-Cas9, to disable the function of these genes. We first transform our CRISPR-Cas9 constructs into T. versicolor roots to introduce mutations in the coding sequences of the target genes. We then evaluate the ability of mutated roots to develop haustoria and observe for any abnormal haustoria development. This research will identify genes and pathways necessary for haustorium development, which could be used to engineer host resistance by silencing haustoria-related genes.

## Parental Emotion Socialization and Depressive Symptoms in Adolescents

*Jingqi Li* Sponsor: Paul Hastings, Ph.D. Psychology

Greater emotion dysregulation during adolescence is linked to depression, and parent's emotion socialization is associated with adolescents' emotion regulation. Using youth gender as a moderator, we hypothesized that girls experiencing more negative maternal responses (NRE) would report higher levels of depression than boys, with symptoms increasing over time. At Time 1 (T1), 220 mothers reported their NRE. At T1 and Time 2 (T2, 2 years later), youth ( $M_{age at T1}$  = 13.67) reported their depressive symptoms. A regression model was used to predict youth's depression at T2 from mothers' NRE at T1 and youths' gender, controlling for youths' depression at T1. Although NRE did not predict depression directly, the interaction between NRE and gender was significant. NRE predicted increases over 2 years in depressive symptoms for girls, but not boys. In line with empirical findings supporting the role of parental emotion socialization as a predictor for depressive symptoms, our findings suggest that this pattern was only evident in girls. It is possible that gendered emotions contribute to adolescents' emotion expression, or it is possible that boys are more susceptible to their peers' emotion socialization during adolescence.

## The Influence of Climate Variables and Disease on Plantago lanceolata Survival

## *Qiuying Liao* Sponsor: Jennifer Gremer, Ph.D. Evolution & Ecology

This project is a continuation of a study on the globallydistributed perennial plant Plantago lanceolata that has been conducted annually since 2016. Studying global P. lanceolata populations in relation to climate change helps to inform the development of persistence models. The protocol of Plant Pop Net, an international project, was used to execute our study. Plant Pop Net aims to comprehend the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the globe. At our site in Davis. CA. we measured the abundance and phenotypic traits of P. lanceolata for five years. Data collected includes leaf length, inflorescence length, disease presence, and other phenotypic traits. We would like to investigate the influence of climate variables and disease on plant survival. Using compiled data, we will look at variation in precipitation and temperature to see if there is a correlation with yearly plant survival. In addition, yearly survival will be compared to the proportion of plants containing disease. We predict that individuals with disease will experience reduced survival compared to those without. Further, we expect higher precipitation and temperature to result in increased survival.

## Chlamydomonas Reinhardtii as a Sustainable Platform for Insulin Production

# *Pin-Ru Lin* Sponsor: Marc Facciotti, Ph.D. Biomedical Engineering

As the demand for medicine continues to grow, current methods of therapeutic protein production can be expensive and unsustainable. Our project aims to genetically engineer Chlamydomonas reinhardtii to produce the mini-insulin recombinant protein in an effort to make medicine production sustainable and cost effective. C. Reinhardtii is a single-celled eukaryotic algae whose chloroplast is capable of producing therapeutic-grade proteins. Because C. Reinhardtii is relatively inexpensive and only requires sunlight, low-filtration water, an inexpensive buffer, trace minerals, CO2, and a nitrogen source to survive, it is an ideal platform for inexpensive protein production compared to current methods. We report our progress towards investigating the potential of C. reinhardtii as a protein production platform, and our progress towards genetic construct design and algal strain engineering with miniproinsulin as our primary candidate protein. Currently we are designing our protein purification protocol for when we return to the lab in person. The Algae to Insulin Project is part of BioInnovation Group, which is one of the first undergraduaterun research organizations at UC Davis providing undergraduate students with collaborative and innovative research experience.

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

#### Ryan Lin

Sponsor: Keith Baar, Ph.D. MED: Physiology & Membrane Biol

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

## Effect of Piroxicam, Oxaprozin, and Diflunisal on Proteasome Activity in Heart Tissue

Sophia Lin Sponsor: Aldrin Gomes, Ph.D. MED: Physiology & Membrane Biol

Piroxicam, Oxaprozin, and Diflunisal are three prescription nonsteroidal anti-inflammatory drugs (NSAIDs) that are used to reduce inflammation and pain. NSAIDs are now known to have side effects on the heart. However, the effect of these NSAIDs proteasome activity in the heart is unknown. This project investigates if these three NSAIDs can cause an effect on proteasome activity in H9C2 cardiac cells. The proteasome has three independent proteolytic activities, beta 1, beta 2, and beta 5 activities. Proteasome activity was measured using specific proteasome substrates and proteasome inhibitors as controls. The preliminary results suggest that Oxaprozin decreases the relative beta 1 and 2 activities. Piroxicam and Diflunisal had no effect on the proteasome activities. Proteasome modulation is usually linked to reactive oxygen species (ROS) alteration in the live systems, so the second method utilized was the measurement of total ROS concentration in H9C2 cells by determining the fluorescence of Dichlorofluorescin Diacetate (DCFDA) oxidation. In both methods, each drug was tested with two concentrations that were calculated based on the levels of these NSAIDs found in human blood after oral intake. The results suggest that different NSAIDs may have different effects on cardiac cells.

## *Qiuying Lin* Sponsor: Colin Carter, Ph.D. Ag & Resource Economics

Because of the Covid-19 pandemic, SMEs (small or mediumsized enterprises) encounter many difficulties such as cash flow shortage, decreased revenue, concern about the instability of the future, etc. Commercial banks play an important role to help them survive during this tough period, providing financial services and facilitating financial measures. However, the lockdown restricting people's travel requires the digital transformation of commercial banks. This paper analyzes three different commercial banks in the world, Bank of China, JPMorgan Chase, and Credit Agricole to see how digital transformation works during pandemic. I investigate the structure change, implementation of big data, seasonal financial reports, stock price trends, and digital products of banks to reveal the benefits and challenges of digital banking compared to traditional banking. Additionally, to understand the relationship between banks and customers under digital transformation, I study the new communication ways and try to estimate the royalty rate based on indexes such as nonperforming loan ratio, monthly active users, etc. Furthermore, studying the government and federal policy, I also analyze the environment for the development of digital banking.

## **Optimization of Exosome Transfection in ARPE-19**

*Ethan Lindgren* Sponsor: Zeljka Smit Mcbride, Ph.D. MED: Eye Center

Diabetic Retinopathy (DR) is an ocular disorder characterized by microvascular changes in the eye. Our lab has previously identified a set of microRNAs (miRNAs) dysregulated in DR patients' ocular fluids. miRNAs are small non-coding RNAs that may play a role in DR pathogenesis and can be packaged in exosomes, natural carrier, and delivery vehicles. The long-term goal is to develop miRNA-based early biomarkers and therapies for DR. The short-term goal was to optimize the transfection rate of a human retinal pigment epithelium (ARPE-19) cell line by exosomes and determine which cellular labeling is most effective. The concentrations of exosomes and the incubation period of transfected ARPE-19 were varied to determine which conditions allow for the highest transfection rate. We used two sources: mesenchymal stem cells (MSC) exosomes labeled using ExoGlow (red-fluorescent dye) or HEK-293 exosomes X-Pack GFP-loaded (green-fluorescent protein). ARPE-19 were labeled using an Oregon Green Phalloidin or CellTrace calcein red/orange AM and were imaged using an Olympus FV3000 confocal and ImageXpress XL high-content microscopes. Results indicate that the highest transfection rate was achieved when 0.23ug of exosomes were added to 10,000 ARPE-19 cells, after a 5-hour incubation period.

Adolfo Lista Nicoloso Sponsor: Jonathon Schofield, Ph.D. Mechanical & Aerospace Engr

As technology becomes more advanced, the quality of prosthetics increase, decreasing affordability and depriving many of access to these devices. With an increase in the need for innovation and cost-effective prostheses, our team is set on designing a higher performance prosthetic using sustainable and affordable materials. Working with a leg amputee directly, our below-the-knee prosthetic leg prioritizes comfort and adaptability for an active lifestyle. Our design is divided into 3 main parts being the pylon, socket, and foot. We conducted a concept screening to define the core concepts within each part. These include a vertically rotating ankle, self-molding socket interior, and a shape that allows for full range of motion at the knee. We are currently developing the pylon and the foot of our design by conducting extensive material and biomechanics research to achieve optimal performance during the Gait cycle while walking and jogging, turning, and even going up and down stairs. Throughout the process we will validate and verify our design to ensure the client's needs are properly assessed. Once we establish a working design, we will create a CAD model and proceed with the testing and prototyping phases.

## The Influence of Classroom Language Environment on Bilingual Language Proficiency: Mexican-American and Chinese-American Dual Language Learners in Head Start

*Mei Liu* Sponsor: Yuuko Tonkovich, Ed.D. Education

Research shows that classroom language has a role in children's language development with both monolingual and dual language learners (DLLs), particularly for children from lowsocio-economic homes. The limited past studies that examine classroom language have focused on Spanish-English DLLs. However, DLLs are a heterogeneous group and more research needs to be done with DLLs from other language backgrounds. This study examines (a) the difference between Mexican-American (MA) and Chinese-American (CA), (b) the effect of lead teacher verbal communication on DLLs' language skills, and (c) correlation between the frequency of English language and heritage language use by lead teachers and DLLs. Classroom language environment was assessed using the Language Interaction Snapshot (LISn) that captures language interactions of a total of 12 MA and 13 CA preschoolers in Head Start settings. Each participant was observed for 5 snapshots for a total of 25 minutes between spring and summer 2019. Each child's oral proficiency was assessed using the Woodcock-Johnson IV Tests of Oral Language. Preliminary results show that teachers with CA DLLs spoke in HL more than teachers with MA DLLs. CA DLLs also talked to their teachers in HL more frequently than MA DLLs. Implications for educators will be discussed.
#### *Louisa Liu* Sponsor: Andrea Schreier, Ph.D. Animal Science

The presence of plastic waste in the oceans poses a major threat to marine ecosystems. Numerous marine organisms become entangled in or unintentionally ingest plastic debris, and yet, much of the population is unaware of the consequences of single-use plastics. This project aims to investigate single-use plastic consumption in local restaurants in Davis in order to develop a collaborative model that can be adapted to support and encourage restaurants to transition away from single-use plastics in Davis and other cities. This collaborative model would allow project stakeholders to use social capital to incentivize the reduction of single-use plastic in restaurants through community promotion. We will conduct research regarding conventional material costs, costs of alternatives, how current businesses incorporate compostable products, and consumer preference for sustainable materials. By investigating the cost and process of transitioning from conventional to compostable materials, we can determine the feasibility of convincing local businesses to employ this model throughout the city.

# Investigating the Response to Health-Related Messages Over Social Media

# *Siyan Liu* Sponsor: Debbie Fetter, Ph.D. Nutrition

In the US, about 7 of 10 individuals use social media to seek out information. However, this widespread use of social media means there is an increased risk of finding false information, especially for health-related topics.

Message framing is a fundamental component of communication strategy that can influence exposure of a message. Messages can be framed to emphasize either the benefits of engaging in a behavior (a gain-frame), the consequences of failing to participate in a behavior (a loss-frame), or the potential danger of not adopting recommendations (a fear appeal).

This study will develop gain-framed, loss-framed, and fearbased health messages to investigate the response between a population with high-use of social media versus one with lowuse. Participants will complete a survey about their social media use, perceived level of knowledge about these health topics, and responses to these health messages in the different framings. Questions will be included to measure perceived accuracy, how likely they would be to share the message with their social network, and self-efficacy towards behavior change. The results can be used to investigate how to more effectively disseminate health messages over social media to help individuals adopt beneficial behaviors.

#### Audrey Loaiza Sponsor: Neelima Sinha, Ph.D. Plant Biology

In maize and Arabidopsis, the microRNA miR156 controls the transition between the juvenile and adult phases of development, where high levels of miR156 promotes juvenile traits and low levels permit adult traits. My project will examine what traits are controlled by this microRNA in the genus Acacia. In particular, juvenile and adult leaves in Acacia are known for their distinct morphological adaptations to the unique environmental differences experienced during their life history. Using plant tissue culture and transformation techniques, I will transform Acacia crassicarpa leaf tissue with Agrobacterium containing constructs that over and under express miR156. Transgenic plants will be created using a protocol that induces regeneration, shoot induction, shoot elongation, and root induction. Plants will be confirmed for transgene insertion using PCR and will be acclimated to the environment by transferring them to soil. Using these plants, I will examine which leaf traits are regulated by miR156. The expected phenotypes are compound, juvenile leaves in those with overexpression of the gene and simple, adult leaves in those with under expression of the gene. These findings will determine what role miR156 plays in leaf development in Acacia crassicarpa and given insight into the evolution of leaf morphology within the genus Acacia.

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

*Palavi Lodhia* Sponsor: Pamela Lein, Ph.D. VM: Molecular Bio Sciences

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

#### Assessing the Influence of Task and Working Memory Capacity on Eye-Movement Characteristics During Scene Perception

#### Zoe Loh

Sponsor: John Henderson, Ph.D. Psychology

Recently, Luke and colleagues (2018) found an association between lower working memory capacity and longer fixation durations. This study attempts to conceptually replicate their results while investigating the effect of task on fixation durations. Participants (N = 100) performed two tasks, aesthetic judgement and memorization, while viewing 100 real-world scenes. Working memory capacity was assessed with an operation span task and a memory updating task. We characterized each participant's fixation duration distribution by fitting an Ex-Gaussian function, which generated three parameters: the mu (mean of the normal), sigma (standard deviation of the normal), and tau (the tail). We then fit separate linear mixed effects models with individual difference measure scores as the independent variable and eye movement parameters as the dependent variable. We found significant effects of task for mu, tau, and mean saccade amplitude suggesting that participants were moving their eyes differently during the two scene-viewing tasks. Participants' performances on both working memory tasks were not predictive of any eye-movement characteristic, though we did find that the task participants are engaged in influences fixation durations.

# Learning to Look in a Pandemic: An Exploration on the Impact of Masks on Infant Facial Recognition

Jasmine Lomeli Aceves Sponsor: Lisa Oakes, Ph.D. Psychology

From birth, infants preferentially look to the faces in their environment. Across the first year of life, infants prioritize different regions of the face (e.g., the eyes or mouth) as various visual cues become more or less relevant. For example, as infants learn language, they may prioritize their attention to the mouth of a speaker (Lewkowicz & Hansen-Tift, 2012). As a result of the COVID-19 pandemic, face masks have become a part of daily life for many Americans, raising the question: will face masks affect our ability to recognize one another? Studies investigating this question have found that adults are impaired at both learning and recognizing faces with masks (Carragher & Hancock, 2020). Given the importance of faces for infants' learning, we tested whether infants would show differential learning and recognition patterns to masked and unmasked faces. Additionally, we asked parents to report on their infant's experience seeing people wear face masks. To date, we have tested approximately 50 infants aged 4- to 12-months online and are currently analyzing this data to present in the Spring. This work will contribute to our understanding of how various aspects of facial input are related to infants' learning across the first year of life.

#### Cryo E.M Low-Cost Sample Preparation Device

Andrea Lopez Arguello Sponsor: James Letts, Ph.D. Molecular & Cellular Bio

Cryogenic electron microscopy (Cryo-E.M) is a well-established method in structural biology used to create 2D and 3D structures of macro-molecular complexes such as the bioenergetics proteins. A critical part of the sample preparation process requires devices that can cost over fifty-thousand dollars. While Cryo E.M produces accurate visualizations of molecules with the help of rapidly advancing computer software and microscopes, the sample preparation process has not made as rapid advancements in technology. By improving methods of the sample preparations process can result in more efficient data collection, and result in improved structure images. Instead of micropipette transferring the biological solution to the grid surface, the sample will be transferred by humidification. The grid surface is held by a pair of tweezers magnetically connected to a moving plunger. A solenoid will plunge the grid carrying the biological sample, and submerged into a cryogenic bath of liquid ethane. The solenoid is controlled by the customized printed circuit board connected to the raspberry pi. A series of python scrips will control the signals sent through the device controlling the voltage. Upon completion this device will be able to effectively vitrify sample, while itself being a much more affordable and modifiable device.

#### Understanding COVID-19 Vaccine Information Access and Hesitancies

*Vivian Lu* Sponsor: Jingwen Zhang, Ph.D. Communication

As the COVID-19 pandemic continues to affect the world and with new virus variations posing unknown challenges, promoting the COVID vaccines to decrease virus spread and the death toll is a public health priority. Though the FDA approved vaccines have been shown effective and safe, significant COVID vaccine hesitancy has been identified in research across different populations in the U.S. This research examines the extent of COVID vaccine hesitancy across different socio-demographic groups in the U.S. and its contributing factors. Through an online survey involving a sample of 1000 U.S. adults we aim to understand the prevalence of COVID-19 vaccine hesitancies and the reasons why these hesitancies exist. In the project, we hope to determine if individuals are influenced by information sources such as where a person gets vaccine information from, and certain psychological factors including political ideologies and conspiracy ideation. Survey results will provide insights to tailor health communication campaigns to increase COVID-19 vaccine understanding, adoption, and adherence.

*Mengmeng Luo* Sponsor: Kate Scow, Ph.D. Land Air & Water Resources

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

# Social Compensation or Augmentation: Does the Intensity of Social Media Use Influence Bicultural Individuals' Ability to Reduce Acculturation Stress and Bicultural Conflict?

Stephanie Ly Sponsor: Jorge Pena, Ph.D. Communication

The popularity of social media sites and apps has stimulated research on how its habitual use is linked to increases or decreases in social capital, loneliness, and well-being. However, there is less research on how bicultural individuals use social media to navigate their belonging to two or more cultural groups. In particular, bicultural conflict describes the degree to which individuals perceive tension between their two identities. This factor is correlated with their ability to shift between cultural lenses, acculturation stress, social network diversity, and mental health. An MTurk survey sample (N = 725) was recruited to explore the link between social media use, acculturation stress, and bicultural conflict. Path analyses indicated that, among bicultural individuals, intensity of social media use was positively associated with acculturation stress factors such as increased language skill difficulties, race-related work perceived discrimination, challenges, intercultural disagreements, and cultural isolation. In turn, these factors were associated with increased bicultural conflict. Social media use was also directly linked to augmented bicultural conflict. The results supported the social compensation hypothesis as they imply that bicultural individuals use social media to cope with societal pressures but in doing so, experience increased acculturation stress and bicultural conflict.

### A Review of PFAS Effects on Animal Models: Reproductive and Developmental Health Impacts

Anna Maddison Sponsor: Michele La Merrill, Ph.D. Environmental Toxicology

Per- and polyfluoroalkyl (PFAS) chemicals are used in the production of many consumer goods and various industrial processes, and they have been widely detected in samples from both humans and animals. PFOS and PFOA have been comprehensively studied and are being phased out of use, but there are many other understudied PFAS chemicals with potential adverse effects that should be considered in regulatory affairs regarding public health and safety. In this study, we focus on how the reproductive health and development of animal models is affected by exposure to seven chemicals: perfluorononanoic acid (PFNA). PFAS perfluorohexanoic acid (PFHxA), perfluorohexane sulfonic acid (PFHxS), 4,8-dioxia-3H-perfluorononanoic acid (ADONA), perfluorobutane sulfonic acid (PFBS), perfluoroheptanoic acid (PFHpA), and perfluorodecanoic acid (PFDA). This literature review presents the observed reproductive and developmental effects of these chemicals on animal models, which can be used to help establish legislative priorities and draw attention to current gaps in published research.

# Investigation of Substrate Processing in the Liver to Help Explain the Association Between Fatty Liver and Pesticide Exposure

Anna Maddison Sponsor: Michele La Merrill, Ph.D. Environmental Toxicology

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

#### How Does One's Mood Affect the Processing of Words?

#### The Effects of Mood on Top-down Versus Bottom-up Language Processing

#### Neha Madugala Sponsor: Tamara Swaab, Ph.D. Psychology

Mood can influence whether individuals rely on bottom-up or top-down mechanisms in word processing. We plan to conduct a mood induction study to see how mood influences accuracy and speed in a semantic priming paradigm accompanied by a lexical decision task that relies on bottom-up processing. Mood will be induced using happy or sad music. The lexical decision task will have participants decide if the target is a real word or pseudoword created using internal transpositions. The paradigm will have the following four conditions: related prime with a real word, unrelated prime with a real word, related prime with a pseudoword, and unrelated prime with a pseudoword. A negative mood is associated with 'local' processing, so we expect higher accuracy in identifying transpositions; whereas, a positive mood is associated with 'global' processing, so we expect semantic priming to have a stronger influence. By fitting a linear mixed model to the conditions created by mood induction and word pairings, we expect that the positive mood group would have a poorer performance but faster response while the negative mood group will have a greater performance but slower response in identifying pseudowords. These findings assess how mood influences attentional mechanisms in word processing.

# Use of Computational Physics Tools and Molecular Dynamics Simulations to Predict and Test Binding Affinities of Amino Acid Polymers with the SARS CoV-2 Spike Protein and its Receptor-Binding Domain(RBD)

Rustin Mahboubi-Ardakani Sponsor: Daniel Cox, Ph.D. Physics

The worldwide outbreak of SARS CoV-2 has highlighted the issue of achieving reliable binding of manufactured proteins to individual virus particles (virions) both for capture (in detection) and neutralization (in therapeutics or prophylactics). Computational physics tools such as molecular dynamics programs can be used to test binding affinities of amino acid polymers with the Covid spike protein in order to predict how effectively mutant strains will bind to proteins in vivo, or how effectively synthesized polymers can neutralize the Covid spike protein (and its mutants). Furthermore, these computational simulation tools can be used to predict how SARS CoV-2 will escape from antibodies produced in response to infection or inoculation, thus allowing us to understand how and why mutant strains such as the Brazil, South Africa, or UK strain escape from antibodies and increase infectivity. Here, we use the molecular dynamics program YASARA to run simulations and gather information about hydrogen bonds, interface surface area of antibodies bound to the SARS-CoV-2 Spike protein, and input the simulated structures into HawkDock, a server which estimates binding energy using the Generalized Born Surface Area method for computing the energy of solvation due to electrostatic and entropic contributions.

#### Part Preparation and Cable Routing within a CubeSat

#### Freshta Malikzada Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

REALOP is the first UC Davis undergraduate-based CubeSat team with a launch scheduled for late 2021. Under mission REALOP, the Structures team has developed a cable harnessing model and prepared a process for manufacturing. More specifically, the parts preparation subteam is responsible for manufacturing preparation as well as creating validation and verification documents. The cable harnessing subteam is responsible for acquiring cable lengths and organization for use in electrical wiring. For parts preparation, drawings of every component as well as tolerances were made for use in manufacturing. Then Interface and Control Documents (ICDs) were developed to detail how each component interfaces with one another during assembly. Mechanical Part Inspection Documents (MPINs) were also created to verify if the manufacturers made the components correctly. For the cable harnessing subteam, Solidworks was used to provide a reasonable representation of the wiring in the CubeSat in order to obtain wire lengths. Drawings of the wire lengths were then generated for use by the electrical team. Both teams in tandem provide a basic schematic of how the CubeSat is assembled, but more importantly also expose members to the documentation and practices that go into spacecraft development, increasing the efficiency of developing future CubeSats.

#### Operationalizing Social Environments in Cognitive Aging Research

Pallavi Malladi Sponsor: Rachel Whitmer, Ph.D. MED: Public Health Sciences

"Social and built environments" is a phrase commonly used to refer to social determinants of health (e.g., neighborhood characteristics) that operate at the broad, ecological level. While the "built environment" is clearly operationalized in empirical studies as physical surroundings made by and for humans, the "social environment" remains ambiguous. Theoretical and empirical definitions of social environments have encompassed varied interpersonal (e.g., social network structures) and social exposures (e.g., aggregate measures of socioeconomic status) that operate at different levels of analysis with presumably different mechanistic processes. This scoping review aims to examine how social environments are operationalized and their effects on cognition, cognitive decline, mild cognitive impairment, or dementia. We performed a systematic search on PubMed and Web of Science using MeSH and keyword terms to identify observational/epidemiological studies investigating social environments as a risk or protective factor for late-life cognitive outcomes. Of 7,714 identified studies, 85 met the inclusion criteria based on title and abstract. The findings of these studies will be contextualized within public health, sociological and gerontological theories of social environment and will be used to develop a framework to advance the science of cognitive aging and risk reduction.

# Associations between Age and Brain Connectivity in Sample of Adults

# *Karina Mandujano Rojas* Sponsor: Johnna Swartz, Ph.D. Human Ecology

Studying the strength of connections in the brain can reveal important information about structural and functional organization of the brain and may help in understanding changes that occur during aging. The goal of this study is to understand how brain connections change with age. More specifically, this study aims to test the hypothesis that the connections of the language network will either strengthen or stay stable with age, whereas connections made by regions such as the sensory motor lateral network will weaken, given that motor control often declines with aging. A subset of 122 participants from a national sample of Americans (25-74 years old), from the Midlife Development in the U.S. (MIDUS) Study, which is a national longitudinal study of health and well-being, was used to test this hypothesis. The study collected data through surveys, clinical, biomarker, and functional magnetic resonance imaging (fMRI) data. Resting state fMRI data, which allows for the examination of connection strength within brain networks, has been preprocessed through the use of a pipeline and is currently being analyzed. Results from this study will help provide further insight into how brain connectivity changes which age and how different networks vary in terms of their connectivity.

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

Angelica Martinez Sponsor: Kristina Horback, Ph.D. Animal Science

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

# Stereotypes Pertaining to Undocumented Immigrants of Color in America, the Damaging Effects, and Possible Radical Solutions

#### Adamarys Martinez Sponsor: Daniel Melzer, Ph.D. University Writing Program

Being undocumented myself, I'm able to see first hand how America stereotypes immigrants, especifically those who are undocumented, and the effects that these stereotypes have. In this research project, I explored the different stereotypes that various ethnic immigrant communities of color have had to endure and where these stereotypes come from, while searching deeper into the social, psychological, and economic effects that undocumented immigrants have faced. This research includes experiences from Black, East Asian, and non-Black Latinx immigrants. I also included information on past techniques and methods in which immigrants of color have fought against these stereotypes and their effects, including examples of actions taken by East and South Asian immigrants. These solutions revolve around the practices of creating organizations for both immigrants and allies, joining and creating communist parties across the country to find a solution to the exploitation of immigrants caused by capitalism, and using the act of civil disobedience to create desired changes. To gather this information, I collected and analyzed academic texts and literature.

# Examining the Effect of Cultural and Prescribed Burning on Herbivory in Culturally Significant Plants of the Cache Creek Area

Maya Martinez Sponsor: Beth rose Middleton Manning, Ph.D. Native American Studies

Cultural burning is a practice done by numerous Indigenous groups in order to improve the gualities and densities of ecocultural resources central to subsistence and spiritual practices. One of the many benefits of cultural burning is the reduction of pest populations in plant species deemed significant by the respective tribe. This pilot project will build upon past knowledge and both qualitatively and quantitatively show the effect of cultural burning on herbivory in culturally significant plants of the Cache Creek area. This will be done through interviews with the tribal and community members of this area in conjunction with the post-burn examination of herbivory upon select plant species over different time intervals. I predict that interviewees will discuss the ecocultural and ceremonial importance of cultural burning and highlight the differences between Indigenous-led and governmentsanctioned fire. In addition, I believe that cultural burning will initially reduce insect herbivory and increase mammalian herbivory. However, over time, both types of herbivory will increase. This project aims to demonstrate the value of Traditional Ecological Knowledge (TEK) in local land management practices. Equally as important, this study will display the cultural value of burning for the Native people of this area.

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

#### Valencia Martinez Sponsor: Magdalena Wojcieszak, Ph.D. Communication

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

# Racist Digital Media and College Students' Wellbeing In the

# Context of COVID-19 Pandemic

# Carolina Martinez Sponsor: Adrienne Nishina, Ph.D. Human Ecology

In the context of the ongoing COVID-19 pandemic, social interactions have relied more on digital platforms. Although a useful tool, digital media can also expose users to negative content such as racist rhetoric, especially as the COVID-19 pandemic may have exacerbated racial tensions. The present study aims to understand the relationship between exposure to racist behaviors online and self-reported mood. This online study drew from a college sample amidst the COVID-19 pandemic. Participants were 227 students (35% White, 32% Asian American, 13% Latinx, 2% Black, 18% Multiracial/Other; 74.3% girl, 22.9% boy). The findings showed that viewing a racist image of their race/ethnicity via digital media was positively associated with feeling more worried, r (207) = .26. p < .05. Additionally, seeing others being treated negatively due to their race/ethnicity via digital media was positively correlated with feeling worried, r (208) = .17. p < .05. These findings suggest the need for maintaining safe spaces on digital media platforms and improving protections for those who are targeted. These findings highlight the comparable consequences on college students' well-being that may arise from witnessing racial discriminatory behavior, regardless of direct or indirect exposure.

# Caste and Caste-ism: An ethnographic study of the socialization of Indian expatriate children growing up in the UAE

#### *Radhika Marwaha* Sponsor: Nicole Ranganath, Ph.D. Middle East/South Asia Program

This study explores caste among expatriate Indians in the Gulf region, a vital topic of research that remains unexamined by scholars. The discovery of oil in the Gulf states in the midtwentieth century has attracted over 8.5 million South Asian expatriate workers in search of greater economic opportunities. Caste, a 2,500-year-old system of social stratification that originated in the Indian subcontinent, still largely influences a community's social status. Although in the 1950s, caste-based discrimination was abolished in India's Constitution, caste-based oppression, and consciousness, continues to persist across religious boundaries. This study seeks to address: what role do caste and caste-consciousness play among expatriate Indians living in the Gulf? Education is a vital part of the perpetuation of caste identity. In the UAE, the presence of Indian academic institutions provides an essential space for understanding the socialization of children born and/or raised in the Gulf about caste identity. Through ethnographic research, this project explores the process by which privileged Indian students in the UAE see themselves and the world. Although caste identity is different in the diaspora, it is still meaningful within new contexts. Finally, it proposes an anti-caste intervention specific to privileged expatriate students in the UAE.

# Assessing the Impact of Acculturation on Attitudes and Behaviors Towards Domestic Violence in Arab Refugees

### *Radhika Marwaha* Sponsor: Patrick Koga, Ph.D. MED: Public Health Sciences

Domestic Violence (DV) is the action of targeted violence on an intimate partner, a child, or someone else with an assumingly reduced agency in the family. Often in patriarchal structures that are deeply embedded in the two cultures of interest in this study - Arab and Afghan culture, the DV victim often happens to be a female. Despite being raised with these ideologies and being socialized into justifying and accepting violent behaviors directed towards them, victims living in the US begin learning about American family values and legal protections that are in place to prevent DV. Amidst their acculturation and assimilation process, victims are able to change their attitudes and start rejecting violent behaviors directed towards them. However, there are barriers to behavioral change that require the use of culturally relevant interventions that can only be carried out with the help of a victim-centered, quantitative tool that assesses both attitudes and behaviors for a given demographic. The ABeT-DV Scale developed by the UC Davis team is instrumental in filling this research gap and paving the way for changes in policy and practice for DV victims in the Middle Eastern -American communities.

#### 3D Coculture With Fibroblasts Maintains the Phenotype of Primary Rhesus Macaque Type II Alveolar Epithelial Cells

#### *Noah Marx* Sponsor: Lisa Miller, Ph.D. VM: Anat Physio & Cell Biology

Type II alveolar epithelial (AT2) cells are specialized cells that make up approximately 5% of the surface area of the alveoli. AT2 cells are responsible for the production of surfactant as well as several antimicrobial agents. They also function as progenitor cells for the repair process after lung injury. Despite their importance to pulmonary biology, AT2 cells remain relatively understudied because they are very difficult to culture in vitro. In a conventional two-dimensional culture system, primary AT2 cells lose their distinctive phenotype within 3-5 days, which makes this system unsuitable for most studies. To solve this problem, we utilize a three-dimensional coculture system employing primary rhesus macaque fibroblasts to maintain the phenotype of primary rhesus macaque AT2 cells. In this system, the primary AT2 cells are grown in a monolayer on top of a Matrigel matrix containing the primary fibroblasts. The contact between the fibroblasts and AT2 cells, in addition to growth

factors present in the culture medium, maintains the sftpc<sup>+</sup> phenotype of the AT2 cells for at least 7 days. This model will enable further investigation into the effects of various compounds including wildfire ash and e-cigarette liquids on the health and function of AT2 cells.

# Investigating the Physiological Role of SYCP3-BRCA2 Interaction During Meiotic Recombination

*Kimiko Masaki* Sponsor: Neil Hunter, Ph.D. Microbiology & Molec Genetics

Homologous recombination (HR) is an error-free mode of DNA repair required to maintain genomic stability in all cell types. Breast cancer susceptibility protein, BRCA2 plays a central role in regulating HR. In germ cells, HR ensures proper chromosome segregation and creates genetic diversity through crossing over between homologous chromosomes. SYCP3 is an essential structural component of the meiosis-specific synaptonemal complex that mediates the connection of homologous chromosome pairs. SYCP3 is aberrantly expressed in some tumors and has been assigned to the Cancer Testis Antigens, a group of germline-specific genes that are misexpressed in cancer. Previous studies have reported a SYCP3 and BRCA2 interaction which suggests a critical role that impedes efficient HR in cancer cells. However, whether SYCP3 has any role in regulating recombination during meiosis remains unclear. I investigated recombination defects in a Sycp3 knockout mutant female mouse model since they are subfertile. Our preliminary data suggests extensive delay in the progression of meiosis accompanied by a significant reduction in BRCA2 function as indicated by reduced numbers of recombination foci containing the RAD51 and DMC1 proteins. These results suggest that BRCA2 and SYCP3 interaction might be important for proper repair of the programmed DNA damage that occurs during meiosis.

# Development of a Rotational Testbed for CubeSat Imaging Slew Requirements

*Billy Mazotti* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

This presentation discusses the research and development of a motorized rotation testbed to define reaction wheel slew requirements in support of UC Davis' REALOP CubeSat mission. One critical goal of the REALOP mission is to capture clear images of the Earth from low Earth orbit (LEO), requiring finely tuned attitude control from the on-board reaction wheels to limit motion blur. This performance requirement was investigated using a microstepping motor to simulate a one degree-offreedom rotational environment for testing the image quality of a Raspberry Pi V2 Camera Module. Through varying the camera's angular velocity, exposure, and ISO, images were captured and then gualitatively analyzed to determine the rotation threshold that the satellite's reaction wheels must maintain to return clear pictures from LEO. Experimental results found a maximum rotation rate of 20°/s and an exposure time of 100 µs at ISO 200 suitable for successful imaging efforts. While the motor step resolution constrained the rotational smoothness of the testbed, this design demonstrates a low-budget option for student teams investigating CubeSat imaging attitude control requirements. The use of an environment more similar to that of LEO, such as a frictionless air-bearing table, is recommended to better simulate unconstrained rotation.

# Pushed Out of Empowerment: Exploring how Latinx Students Experience Discipline at an Urban Charter School

Andrea Medina-Castellanos Sponsor: Michael Singh, Ph.D. Chicano Studies

The graduation rate for Latinx students in California has remained persistently low for the past years. Latinx students are the state's largest racial demographic in both public and charter schools are Latinx, however, they experience disproportionate amounts of exclusionary school discipline, which negatively impacts school attendance and academic success. The disconnect that exists between academic success and the lacking of resources to support Latinx youth in the state of California is alarming and disheartening. In my current research project, I seek to examine: 1) what are the different exclusionary discipline mechanisms that have led to Latinx students having one of the highest dropout rates in California, and 2) which support services and resources are necessary to aid Latinx in achieving academically in the state of California? In steps to begin answering this question, I will be conducting semistructured interviews with a sample of recent high school students who were pushed out between the ages of 18-20 from a charter high school in Oakland, CA. Through this project, I hope to shed more light on how public and charter schools create systems of punishment, which places Latinx students in more harmful education environments.

# Análisis sobre las separaciones familiares de la perspectiva de los hijos e hijas

Jazmin Mendez-Flores Sponsor: Robert Irwin, Ph.D. Spanish & Portuguese

Esta investigación se enfoca en las separaciones familiares ocasionadas por la deportación con una atención particular a los menores/jóvenes que permanecen en los Estados Unidos sin un padre, madre o ambos. Dado a que estudios previos sobre la deportación y la separación familiar se centran en las perspectivas de las madres o los padres, que son repatriados por autoridades migratorias o los que se quedan en los Estados Unidos, esta investigación examina y analiza los impactos que tienen las separaciones forzadas en las vidas cotidianas de los hijos e hijas. En esta investigación se analizan los efectos psicológicos, económicos y los cambios de roles. Se enfoca principalmente en un recurso no previamente estudiado: las narrativas digitales, del proyecto Humanizando la Deportación, varias de las cuales incorporan directamente las perspectivas de hijos e hijas de padres o madres deportados/as. Más allá del material ya publicado en este archivo, una nueva narrativa digital que produje en colaboración con miembros de mi familia para elaborar este efecto desde la experiencia propia. Esta investigación ayuda a entender mejor el daño que causan las deportaciones con el objetivo de descubrir maneras en que las escuelas y comunidades puedan ayudar a estos menores/jóvenes.

# Law Enforcement and Information Technologies: Examining Biases in Police Data Collection Processes through Modern Policing Technologies

Jaqueline Mendoza Rosales Sponsor: Jesse Drew, Ph.D. Cinema & Digital Media

Societal concern over police coercion and violence in communities of color have brought law enforcement under increasing public scrutiny. Criminology and legal scholars often point to a disproportionate impact police technology has on low-income and non-white communities. My research focuses specifically on data collection and information technologies used in modern policing tools, to detect bias and discrimination, through a social determinist perspective. Technology is a system that transforms inputs and produces outputs, a core element explored in this study is the process that shapes input data before law enforcement uses it in technological systems. By examining the practices and scholarship of police technologies, such as predictive policing software and facial recognition, this study will investigate the impact modern data acquisition and processing has on negative outcomes in communities of color. Through a literature review, data investigation, interviews with law enforcement personnel, and software analysis I attempt to answer some of these key questions and propose some solutions to the problem.

# Development of a Novel Small Molecule Inhibitor of Neutrophil Elastase as a Treatment for Pulmonary Diseases

#### *Molly Mermin* Sponsor: Justin Siegel, Ph.D. MED: Biochem & Molecular Med

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

# Tariff Uncertainty, International Productivity, & US Manufacturing Employment

Shannon Meyer Sponsor: Giovanni Peri, Ph.D. Economics

In this project, I consider the case of the U.S. manufacturing sector, which has reported declines in employment in the past few decades. I compare the extent to which regional manufacturing employment has been affected by productivity shocks from international partners, particularly China, to the effects that can be traced to changes in stability of trade relations between the United States and China. Specifically, I augment a regional analysis of the effects of import exposure on regional U.S. manufacturing employment developed by Autor, Dorn, and Hanson (2015) by adapting a measure developed by Pierce and Schott (2016) which captures the level of protection that uncertain trade relations implicitly offered to certain U.S. industries, which was lost after the U.S. extended Permanent Normal Trade Relations to China. The results will provide a framework for understanding the relative importance of the stability of trade relations in local employment outcomes compared to the effects of broader international productivity shocks.

# A Century in the Making: The Historical Context of QAnon's Rise and Spread

### Ann Meyer Sponsor: Kathryn Olmsted, Ph.D. History

In 2017, an anonymous user began posting on the online image board 4chan, alleging conspiracies involving partisan politics and public figures in the U.S. These posts evolved into QAnon, a conservative movement founded on a complex web of conspiracy theories. Since the FBI classified QAnon a domestic terrorism threat in 2019, evident in its visibility at the insurrection on the U.S. Capitol, QAnon has gained footing in over 70 countries and garnered international media attention. Speculation into QAnon's origins and rapid spread prompts many questions, namely why did the movement arise and captivate millions of Americans? My research undertakes these questions from a historical perspective. By contextualizing QAnon and its ideas about religion, race, patriotism, class, and politics in U.S. history, I demonstrate that the movement is a new rendition of old beliefs and anxieties co-opted and applied to present-day society. In particular, I examine well-documented histories of fundamentalist and evangelical Christianity, white power movements and fascism, big business's influence in modern conservatism, and the politicization and weaponization of conspiracy theories. I argue that QAnon and its ideologies are extremist variants of more "mainstream" elements of the New Right in the U.S. during the twentieth century.

# Mechanical and Thermal Analysis of CubeSat Structure for Simulated Launch and Orbital Environments

Angel Meza Terriquez Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The Space and Satellite Systems (SSS) club's REALOP mission is to create a 2U CubeSat expected to launch in 2021. The Structures team of SSS has two analysis sub-teams: mechanical and thermal analysis. The goal of both teams is to simulate launch conditions followed by a transient orbit around the Earth to verify CubeSat nominal operations. To create these simulations, the mechanical analysis team uses Solidworks with launch data provided by Nanoracks and Antares while the thermal analysis team uses Thermal Desktop. The thermal analysis sub-team is in the process of preparing a basic model of the CubeSat to showcase the effects of radiation on the external faces of the frame, as well as internal heat transfer between the inner components/faces of the frame. This analysis determines if insulation or a material finish is needed, and verifies that the CubeSat survives in orbit. The mechanical analysis team performed 11 quasi-static tests; including rotational, translational, and vibrational loads using restrictions such as remote loads to obtain Finite Element Model (FEM) mesh stresses and displacements that fall within expectations. The two teams replicate the conditions that CubeSat will undergo through the use of different software to simulate sensible mission results.

# The Human Right to Water in California: Gauging Drinking Water Quality Disparities in Marginalized California Communities

# Abigail Mighell Sponsor: Ross Butters, Ph.D. UC Center Sacramento

Over one million people in California lack access to high-quality drinking water. This research investigates which populations are most impacted by poor drinking water quality across the state and aims to inform future water policy in California. Specifically, this research compares tribal lands vs. non-tribal lands, unincorporated areas vs. incorporated areas, and minoritydense areas vs. non-minority-dense areas. Through quantitative analysis of water contaminant levels by census tract, I found that tribal lands and unincorporated areas experience significantly higher levels of drinking water contaminants than non-tribal lands and incorporated areas, respectively. I did not find a significant disparity in water quality based on minority density, and I discuss possible explanations for this finding. Finally, I discuss the efficacy of current California water policy and how it can be improved to address these disparities. This research provides important information to government and non-profit water programs that are currently designing water infrastructure improvement projects statewide. Identifying which populations are most vulnerable to poor drinking water quality in California will allow these programs to design more effective infrastructure improvement projects.

# Parental care and the risk of maternally-vectored pathogens: *Ammophila* transmit Strepsipteran parasites to their young

**Rebecca Jean Millena** Sponsor: Jay Rosenheim, Ph.D. Entomology/Nematology

Extended parental care is important for protection against natural enemies but can also create opportunities for parents to vector parasites to their offspring via vertical transmission. Such opportunities are occurring in the case of Ammophila wasps. They have varied offspring provisioning behaviors (i.e. differing numbers of prey brought to the offspring), which have developed in response to evolutionary pressure from nonvertically-transmitted parasites. The more developed behaviors meant to reduce parasitism may actually increase attacks on Ammophila offspring by Strepsiptera, which are endoparasitic insects transmitted through offspring-mother contact. Strepsiptera are unique in how they leave permanent signs of parasitism, visible even in preserved host specimens. We have examined thousands of Ammophila specimens from the Bohart Museum of Entomology for these signs of parasitism, thereby converting the specimens into an extensive dataset with which to investigate this host-parasite relationship. Preliminary analyses show that species with more prey items provided-and therefore more extended parental care-have a greater percentage of stylopized individuals. We are continuing analysis by constructing a generalized additive model (GAM) in R to conduct more rigorous tests.

# Chemical and microbial characteristics of olive fermentations performed at home

#### *Zoe Mitchell* Sponsor: Maria Marco, Ph.D. Food Science & Technology

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

# Predicting Subject Relevance using N-gram Extraction

*Maksim Molchanov* Sponsor: Setareh Rafatirad, Ph.D. Engr Computer Science

N-grams are defined as a sequence of N contiguous words typically drawn from a speech or text corpus that are used for a variety of purposes, particularly transforming language into data, in the fields of computational linguistics and natural language processing. The purpose of this research is to determine heuristics and refine a way to discern meaningful n-grams from those unrelated to the subject of interest, and be able to extrapolate the filtering methods to predict future relevance among topics within computer science. We define "meaningful" as having high correlation between the components of the ngram (i.e. "adversarial learning" is a meaningful bigram while "the machine" is not). N-grams have been gathered and parsed from various technical abstracts, and used in the Google Naram Viewer tool to gather usage statistics over time. We plan to use this data in training an autoregression model to predict usage trends in the next three to five years, to reveal insight about the next big technological idea. The use of other models will be further explored as well. Eventually, these modeling techniques could be extrapolated to other subjects, however more work needs to be done to determine how useful this tool can be.

# The Investigation of Noise Levels in Transabdominal Pulse Oxymetry

*Lilian Molina* Sponsor: Soheil Ghiasihafezi, Ph.D. Elect & Comp Engr

Electronic Fetal Monitoring (EFM) has been widely accepted in obstetrical practice as a technique to reduce the incidence of intrapartum asphyxia by monitoring normal fetal heart rate. Numerous clinical trials have shown that, although normal fetal heart rate (FHR) patterns are a reliable predictor for favorable neonatal outcomes, abnormal FHR has low specificity in fetal depression at birth, leading to a sharp increase in the rate of emergency cesarean deliveries (Martin, 1998). Conversely, measurements of fetal oxygen saturation (SpO2) are shown to be excellent predictors of fetal well-being. In this study, we present a fully non-invasive Transabdominal Fetal Oximetry (TFO) system that provides an objective metric to estimate fetal SpO2, using transcutaneous light measurements at the maternal abdomen. Measurements of TFO are performed by placing a reflectance-mode optode at the maternal abdomen and sending photons into the body to investigate underlying fetal tissue. The TFO system design involves a system prototype comprised of a multi-detector optode, embedded control system, and a customer user-interface software. Furthermore, we investigated preliminary techniques used in spectral analysis to characterize the noise floor of the measured signal captured by the TFO system, to further understand external noise sources.

# The Intercalation of Copper into Bi<sub>2</sub>Se<sub>3</sub> Using Electrosynthesis Methods

*Metzli Montero* Sponsor: Valentin Taufour, Ph.D. Physics

Superconductivity can be induced in bismuth selenide ( $Bi_2Se_3$ ) by intercalating copper (Cu) using electrosynthesis methods. In contrast with other synthesis methods, electrosynthesis allows for greater control over the Cu-intercalation process and preserves the structural integrity of Bi2Se3 , reducing the probability of Cu-Bi substitution.  $Cu_xBi_2Se_3$  is a prime candidate of being a topological superconductor, with studies measuring shielding fractions up to 50%, drops in resistivity measurements, and a hysteresis loop indicating a potential first-order phase transition. It is of particular interest because studies into compounds with similar physical behaviors have led to predictions that the low-temperature phase of  $Cu_xBi_2Se_3$ undergoes a crystallographic phase transition, with the details of the structure and stability debated. In this experiment, electrochemical synthesis methods of intercalating copper into bismuth selenide will be conducted and refined to produce crystals intercalated with high concentrations of copper. These crystals will then examined under nuclear-magnetic spectroscopy (NMR) to determine if CuxBi2Se3 exhibits the shifts in resonance frequency that are unique to superconductors, and since these shifts result from the electromagnetic interactions of the nuclei in the material, it could also be used to analyze the material's structure at its superconducting state.

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

#### **Rebecca Moore** Sponsor: Maja Makagon-Stuart, Ph.D. Animal Science

An increasing number of researchers rely on animal mounted sensors for automated data collection, but do these sensors change the animal's behavior thus influencing the data? Using the laying hen as a model, we sought to determine whether the weight of the sensors (ranging from 3.3% to 7.2% of their bodyweight) impacts their movement within a multitiered aviary structure. We hypothesized that hens with heavier sensors would have more difficulty transitioning between vertical tiers but would habituate to sensor weight over time. Hens (n=59) were housed across six pens. Of these, 50 were individual marked and assigned to one of five treatment groups (four sensor weights and a control). The hens were observed 1 and 14 days after receiving sensors for 3 hours/day. We recorded the number and success of transitions between vertical tiers for each hen. Preliminary results (based on data from two pens) suggest that the presence of a backpack weight impacted the number of transitions attempted, regardless of sensor weight category. The success of transitions was only affected on the first day of observation, indicating the hens habituated to the presence of the sensor.

# Determining Relative Stoichiometry of domain-forming Coq proteins in the Coenzyme Q biosynthetic pathway

Lennyn Morales Sponsor: Jodi Nunnari, Ph.D. Molecular & Cellular Bio

The multicomponent mitochondrial coenzyme Q (CoQ) biosynthetic pathway is required to synthesize the ancient CoQ redox lipid, which is an essential electron carrier in the energy producing mitochondrial respiratory chain. Our lab recently revealed that components of the CoQ pathway assemble into distinct domains on the inner membrane, enriched at ERmitochondria contact sites. We hypothesize that these assemblies facilitate substrate accessibility for efficient CoQ production and distribution. To gain insight into the unexplored structural organization of CoQ domains in mitochondria, we will determine the relative stoichiometry of Coq components tagged with GFP at their endogenous loci in budding yeast. Relative fluorescence intensities will be determined using the known copy number of the focal-localized centromeric protein Cse4 as a standard to compare with Coq proteins. These data will allow us to determine the stoichiometric structure of CoQ domains and will further our understanding of the nature and dynamics of CoQ domains and their importance in metabolism.

*Cliff Moran* Sponsor: Karen Zito, Ph.D. Neuro Physio & Behavior

Neuronal synapses underlie information transmission in the central nervous system; consequently, proper synaptic development and function are essential for perceiving the world around us, integrating information, and making effective decisions. Cell adhesion molecules (CAMs) possess key roles in the establishment and maturation of neuronal synapses. Fasciclin II (Fas II) is a CAM which localizes to the Drosophila neuromuscular junction (NMJ), a glutamatergic synapse. Fas II is orthologous to the mammalian NCAM1 and NCAM2, proteins implicated in synapse development and Alzheimer's-related synapse loss, respectively. I am currently investigating the role of the C terminus of Fas II in Drosophila NMJ development. I have screened over 100 Drosophila lines generated by CRISPR-Cas9 gene editing, identifying several lines with mutations in the C-terminus of Fas II. I am currently investigating the effects these mutations have on the synaptic localization and relative abundance of Fas II and several known regulators of synaptic development through immunohistochemistry, fluorescence microscopy, and quantitative image analysis. Using these methods, I hope to elucidate the role of the C-terminus of Fas II in Drosophila NMJ development.

# Capturing Insoluble, Unstable Titanium (IV) Species in Single Crystal Form

*Merissa Morey* Sponsor: Alan Balch, Ph.D. Chemistry

The coordination chemistry of titanium (IV) halides, especially involving neutral L-type ligands and L-L type chelates, results in fascinating geometries, brilliant colors unusual for a d<sup>0</sup> species, and unusual changes in Ti-X bond lengths. In spite of being a small, hard, highly lewis-acidic metal center, Ti (IV) can surprisingly form eight-coordinate complexes with such ligands. These complexes are excellent starting materials for further organotitanium chemistry and the synthesis of titanium-based clusters and catalysts. However,  $TiX_4(L)_2$  or  $TiX_4(L-L)$  species are typically unstable in solution when soluble, and more often than not, intractable solids that do not dissolve in common organic solvents. A methodology has been developed for smallscale  $TiX_4$ -ligand reactions that result in direct formation of high-quality single crystals. The method has been utilized in elucidating the structures of several insoluble titanium complexes that have evaded crystallographic characterization for generations. The variable chemistry of titanium halides towards members of Group 15 of the periodic table has been demonstrated.

#### Variation in Eelgrass Wasting Disease Severity Affects Consumption Patterns and Preferred Food Availability for Herbivores

# Naomi Murray Sponsor: John Stachowicz, Ph.D. Evolution & Ecology

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

# Interplay of Effective Surface Area, Mass Transport, and Electrochemical Features in Nanoporous Nucleic Acid Sensors

Sachit Nagella Sponsor: Erkin Seker, Ph.D. Elect & Comp Engr

Electrochemical biosensors transduce biochemical events (e.g., DNA hybridization) to electrical signals and can be readily interfaced with electronic instrumentation for portability. Nanostructuring the working electrode enhances sensor performance via augmented effective surface area that increases the capture probability of an analyte. However, increasing the effective surface area via thicker nanostructured electrodes hinders the analyte's permeation into the nanostructured volume and limits its access to deeper electrode surfaces. Here, we use nanoporous gold (np-Au) with various thicknesses and pore morphologies coupled with a methylene blue (MB) reporter-tagged DNA probe for DNA target detection as a model system to study the influence of electrode features on electrochemical sensing performance. Independent of the DNA target concentration, the hybridization current (surrogate for detection sensitivity) increases with the surface enhancement factor (EF), until an EF of ~5, after which the sensor performance deteriorates. Electrochemical and fluorometric quantification of a desorbed DNA probe suggest that DNA permeation is severely limited for higher EFs. In addition, undesirable capacitive currents disguise the faradaic currents from the MB reporter at larger EFs that require higher square wave voltammetry (SWV) frequencies. Finally, a real-time hybridization study reveals that expanding the effective surface area beyond EFs of ~5 decreases sensor performance.

Naina Narain Sponsor: Georgia Zellou, Ph.D. Linguistics

Voice assistants such as Alexa and Siri are now commonly used in the home and everyday life, yet our scientific understanding of these interactions is still in its infancy. This study tests how people of different ages (college-age adults and children, ages 7-12) talk to an Alexa device versus a human. The interactions, conducted over Zoom due to social distancing restrictions, were controlled so that participants said the same sentences to the Alexa and human interlocutors. Subjects see a list of 24 words and, on each trial, the experimenter or device asks what the next word on the list is. The subject replies with the corresponding word on their list ("The word is pig"). Then, the experimenter or device says the word back and asks the subject to repeat the sentence; on 4/24 of trials, the interlocutor mishears the pronunciation, saying a second word with a consonant error ("I heard pig or pick"). Videos are annotated in ELAN and manually checked. We predict that adults and children will show differences in the way they adjust their speech for a human versus Alexa interlocutor. Broadly, this work can reveal the impact of voice assistants on language behavior across the lifespan.

# What are the Roles of Pitch Variation and Word Repetition in Infant Vocabulary Development?

# Naina Narain Sponsor: Katharine Graf Estes, Ph.D. Psychology

Infant-Directed Speech (IDS), also known as baby-talk, is characterized by higher pitch, longer word duration, a wider pitch range, and more word repetition in comparison to Adult-Directed Speech (ADS). Prior research suggests that components of IDS affect infants' language learning. However, we do not yet know how certain linguistic elements, such as varying pitch and word repetition, contribute to infants' vocabulary development. The current study will investigate whether infant vocabulary size correlates with parents' pitch range and/or the number of target word repetitions the parent produces. We will analyze audio recordings of monolingual English-speaking parents playing with their infants (n= 24, ages: 10-12 months) in a task designed to elicit 14 target words (e.g., hat, apple, boat). We will count repetitions of each target word and measure the pitch range for these target words for each participant. We will collect infant vocabulary size via parental reports on a standardized vocabulary form. We expect that parents with high rates of target word repetition and wide pitch ranges will have infants with the largest vocabularies. If confirmed, these findings would suggest that certain characteristics of IDS can be targeted to promote better linguistic development in infants.

# Himshikha Nath Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The purpose of this project is to teach UC Davis's first CubeSat when to collect pictures and IR sensor data. The Space and Satellite Systems (SSS) Club has developed a CubeSat that lays the foundation for low cost missions focused on Earth Science. This mission objective relies heavily on the problem of when to collect data and ensuring the quality of our data. This is accomplished through machine learning and information theory and processing by the Computer Systems Team of SSS. After dedicated research, we have compared and contrasted three methods for teaching our CubeSat: Linear Regression, Logistic Regression, and Support Vector Machine. Our results were verified with mathematical optimization. We are developing a novel data set, which is highly sought after in Machine Learning research, to further test our methods. Future work will include a novel method that will not only teach the machine, but allow it to actively learn at low cost to our power systems.

# Recruitment Practices during COVID-19 From the Perspective of Institutional Agents and Chicanx/Latinx Students

Yadira Nava Sponsor: Natalia Deeb Sossa, Ph.D. Chicano Studies

COVID-19 has caused significant changes in the recruitment practices of Latinx/Chicanx students by the institutional agents of UC Davis, an emerging Hispanic Serving Institution (HSI). Using data from a study that emerged from an existing partnership between the UC Davis' Strategic Diversity Recruitment Initiatives and Transfer Programs, the School of Education, and the Chicana/o Studies Department, I explore if the factors considered by Latinx and Chicanx students for admission to UC Davis align with those believed by the institutional agents at UC Davis? We interviewed 10 institutional agents from UC Davis and 20 Chicanx/Latinx students from different regions of California. Our preliminary results of the interviews conducted with the institutional agents suggest that the most important goal of the webinar- as they believe to be the most important factor considered by students in their admission to UC Davis-was the sense of community. The preliminary results of the interviews with students suggest that housing and financial aid were the most important factors considered in their admission to UC Davis. As an emerging HSI institution, it is important that the intentional recruitment of Latinx/Chicanx students employ culturally relevant approaches that reflect the needs and wants of minoritized students.

#### Galaxy Sizes at Cosmic Dawn

Chloe Neufeld Sponsor: Marusa Bradac, Ph.D. Physics

The study of distant galaxies and their physical properties can provide important information about galaxy formation and the structure and evolution of the universe as a whole. While these early sources of light are much more difficult to observe than nearby galaxies, their properties, such as size and luminosity, can help us gain insight into how the universe has changed since its beginnings. Fortunately, with the help of the gravitational lensing power of giant galaxy clusters magnifying distant objects, we can get a detailed picture of galaxies in the early universe. I will present preliminary results of the sizes of lensed high redshift (z>7) galaxy candidates from the Reionization Lensing Cluster Survey (RELICS), which uses data from Hubble and Spitzer telescopes. I will also discuss the importance of the size-mass evolution of galaxies over cosmic time and the exciting future prospects of the field with the James Webb Space Telescope.

# Effects of Seedling Age and Origin on Drought Tolerance in Streptanthus tortuosus

*Adrianna Ng* Sponsor: Johanna Schmitt, Ph.D. Evolution & Ecology

As mid-winter droughts occur more frequently due to increased variance in winter precipitation, California plants transitioning from seedling to established vegetation can be ensnared in conditions they are not yet ready to face. The timing of drought relative to germination-triggering rains, for example, may ruin a young seedling's chance to reach reproductive age. In this study, I investigated how seedlings of different sizes respond to moderate and severe drought. I also examined whether there are differences in seedlings' ability to withstand drought based on their source population and contextualizing these population responses with local weather data. To investigate how population origin and seedling size affect drought survival, I utilized ten different populations of Streptanthus tortuosus from varying elevations grown in three different age classes -- three, five, and seven weeks old. Over one thousand plants were arown in a growth chamber and subjected to one month-long watering regimes mimicking moderate and severe local drought patterns. I hypothesized that seven week old seedlings from lower elevation populations would perform best as they are nearest to the end of the transition stage and have more experience with warmer growing conditions than their higher elevation counterparts.

#### Development of a Reliable, Low-Cost Reaction Wheel for CubeSat Attitude Control

Dzuy Nguyen Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

This presentation discusses the development of a low-cost Manufactured Reaction Wheel (MRW) system for the REALOP mission, UC Davis's first and completely undergraduate-led CubeSat mission. Commercial reaction wheel systems typically exceed budgets for university missions, so the motor and reaction wheels are independently acquired and joined with a thermal-press fit to ensure cost-effectiveness and reliability. Once in orbit, the MRW will autonomously stabilize and precisely orient the CubeSat so that the satellite's visible light and infrared cameras can take clear photos. The MRW control systems team is developing a methodology to find a PID controller which meets the mission requirements. This process begins with finding a model of the system, applying and tuning the controller, then verifying results with physical testing. A general approach allows for testing on low-cost motors, in preparation for quick and safe tuning of the assembled MRW. Many university CubeSat missions are hindered by the expense of reaction wheel systems; successful use and thorough documentation of REALOP's Manufactured Reaction Wheel system will provide future missions with easier access to lowcost, reliable reaction wheel systems.

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

*An Nguyen* Sponsor: Pamela Lein, Ph.D. VM: Molecular Bio Sciences

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

# Assessing the Development of Visual Short-Term Memory in the Preschool Period Using an Online Change-Detection Task

# Tiffany Nguyen

Sponsor: Lisa Oakes, Ph.D. Psychology

Visual short-term memory (VSTM) is the ability to briefly store and maintain visual representations during disruptions in information that occur during eye movements and blinks. The current study examines VSTM during the preschool period using a change detection task on an online testing platform (Gorilla.sc). In change detection, participants are presented with a sample array containing several different colored squares, followed by a delayed period (during which they have to remember the sample items), and finally a test array containing the previously presented items and one or more changed items. Infants demonstrate their VSTM for the items in the sample array by looking longer at the changed items to the non-changed items in the test arrays (Oakes et al., 2013). We adapted this task and tested fifty 12- to 48-month-old children. Ongoing analyses will provide insight into (1) how VSTM develops from infancy through early childhood and (2) whether we can detect VSTM in children using an online platform.

# Measuring the Effectiveness of Undergraduate Teaching Assistants to Analyze Differences in Instruction in Chemistry Laboratories

# Angela Nguyen Sponsor: Ozcan Gulacar, Ph.D. Chemistry

Beginning in Fall 2017, the Chemistry Department at UC Davis established a pilot program through which undergraduate teaching assistants, formally known as Emerging Scholars (ES), are introduced into laboratory settings to work alongside graduate teaching assistants (TA). To study the differences in student interactions with the TAs and the ESs, every TA and ES was asked to audio record their conversations during two lab sessions. After the audio data were collected, they were first transcribed, and student interactions with the lab instructors were coded using Laboratory Observation Protocol for Undergraduate STEM (LOPUS). Findings of this study will reveal whether students are more comfortable approaching TAs or ESs, and how the teaching styles may vary between the two lab instructors. Student inquiries and TA's or ES's responses will be carefully examined to better understand the instructional styles in the labs. These observations and analyses will reveal the efficacy of the Emerging Scholars program and provide insight on methods to enhance student learning experiences.

#### Does the Nature of Rotation Matter? Assessing Infants' Mental Rotation in an Online Task.

# Austin Nguyen Sponsor: Lisa Oakes, Ph.D. Psychology

Mental rotation, which is the ability to mentally manipulate and make predictions about an object's orientation, is critical for understanding objects in our daily lives. Previous studies have revealed sex differences during infancy, specifically that boys show greater mental rotation than girls (Moore & Johnson, 2008; Quinn & Liben, 2008, Lauer et al., 2015). The goal of the current study was to assess how the nature of the rotation influences infants' mental rotation. We tested infants using an online platform called Lookit (Lookit.mit.edu) that allows families to participate in studies from home. One-hundred-fifty infants between the ages of 6 and 13 months were tested in a modified version of the task used by Lauer et al. In that task, infants were shown two stimulus streams containing identical tetris-shaped items that repeatedly appear and disappear. On every third presentation one stream contained the mirror image of the item in the other stream. We manipulated the nature of rotation by presenting some trials in which the items rotated sequentially (i.e., continuously and clockwise); the remaining trials were nonsequential and random. Ongoing analyses will allow us to evaluate previously observed patterns in mental rotation tasks, including age and sex-related differences.

# Can Women "Have It All?" Can Anyone?

Vanessa Nguyen Sponsor: Giovanni Peri, Ph.D. Economics

As women's labor force participation rates have increased since the start of the Industrial Revolution, many women today strive to have it all: a fulfilling career and family life. Despite the fact that many women are full-time working professionals now, childcare and family expectations still fall largely on them. I use linear probability models to analyze how women's life satisfaction is affected by the presence and interaction of career and family, as well as how "suitable for women" their jobs are in terms of presence of other women and relative wage gap size. Insignificant results so far suggest that careers do not play a major role in women's life satisfaction beyond the imposition of a time constraint that interferes with family priorities. A robustness check on men's life satisfaction suggests that the interaction of career and family is potentially associated with a negative impact on life satisfaction for men as well as women. This leads us to the question of how we can adapt labor force conditions to better accommodate workers who have a secondary job of caring for a family in order to create a happier, more productive workforce.

# Capturing the Lived Experiences of Solidarity Between Latinx/Chicanx and Southeast Asian Undocumented Communities

# Jennifer Nguyen Bernal Sponsor: Monica Torreiro-Casal, Ph.D. Chicano Studies

Communities of color share a history of colonization, oppression, and exploitation. American history has traditionally erased the narrative of communities of color, such as the Southeast Asian and Mexican undocumented communities. The project aims to focus on the concept of solidarity through the outcomes of different movements throughout U.S. history, fighting for civil rights, and explore these movements among the Southeast Asian and Mexican undocumented communities in California. My research is informed by historical movements of solidarity that documented communities of color coming together to fight for the same cause, such as the Third World Liberation Front. These movements fought for issues they believe in, contributing to current movements like Abolish ICE. Implications of solidarity between communities of color lead to potential outcomes that will uplift future changes by mobilizing and organizing to advocate for their community's needs. Taking a qualitative approach, this study aims to invite participants from these communities in places like AB540 and Undocumented center at UC Davis to share lived experiences of solidarity. These findings will give a better understanding of solidarity initiatives among these communities.

# Can California's Chaparral Persist With More Frequent Fires?

Landin Noland Sponsor: Valerie Eviner, Ph.D. Plant Sciences

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

### Latina Health Experiences and Perceived Discrimination in Healthcare Settings

# Juliana Novaes Sponsor: Erin Hamilton, Ph.D. Sociology

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

#### Increasing Accessibility of Healthy Davis Daily Symptom Tracker to Multilingual Communities

*Bianca Eunice Nunez* Sponsor: Prabhu Shankar, M.D. MED: Public Health Sciences

The ongoing COVID-19 pandemic has plagued Yolo County and Sacramento over the past year. As recommended by the Center for Disease Control, an understanding of the symptoms of the disease is necessary to take control measures and prevent spread of the infection. The majority of the mainstream information about COVID-19 symptoms only available in the English language, and families with Limited English Proficiency (LEP) are left at a disadvantage. Creating a multilingual platform can increase accuracy of symptom capture through the translation of healthydavistogether.com COVID-19 symptom tracking and important information about vaccination. The project information will be translated into the popular languages spoken in Yolo County which will be compiled both into a digital library, as well as into a pamphlet in English and other most commonly spoken languages. The symptoms will be depicted with images and checkboxes. The commonly used representations of the disease manifestations will be mapped to the currently used English terms, as well as SNOMED-CT vocabulary. If successfully implemented and maintained, this project will increase awareness, data accuracy, strengthen research, and encourage LEP population participation in COVID-19 public health preventative measures. The model could be generalizable to any future threats by illnesses to public health.

# The Role of Collagen Composition and Orientation in Lateral Force Transmission with Aging

Jed Keenan Obra Sponsor: Keith Baar, Ph.D. MED: Physiology & Membrane Biol

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

# Role of Parent-Child Talk During Book Reading on Heritage Language Proficiency with Spanish-English Dual Language Learners in Head Start Programs

Yuliett Olivas-Gonzalez Sponsor: Yuuko Tonkovich, Ph.D. Education

Studies in early language development with dual language learners (DLLs) have focused on their English oral proficiency. However more research is needed about their home language (L1) proficiency. Studies with monolingual English-speaking families show that interactive parent-child book reading is effective on children's language development. Use of Inferential talk has more cognitive demand compared to referential talk and has led to improved vocabulary in monolingual children, but more research needs to be done with DLL children who may be exposed to primarily L1 at home. This study examines the types of talk parents use when reading to their DLL preschool-aged child and the child's responses during book reading time. Data was collected with 15 Mexican-American parent-child interactions while reading "Frog, where are you?" in their L1. Families were from immigrant backgrounds and the children were enrolled in Head Start programs. All book-reading interactions were transcribed and coded for types of utterance. Preliminary results suggest that parent talk varied in both quality and quantity among parent-child interactions. Children's talk was fairly limited across all parent-child interactions and parent talk did not appear to lead to a higher total of children's responses. Implications and recommendations for families will be discussed.

### Assessing the Effect of Conflict on Affiliation and Self-Directed Behavior in Two Lemur Species

Sara Ostad Rahimi Sponsor: Damien Caillaud, D.V.M.,Ph.D. Anthropology

Conflict has always been a cause of anxiety for animals living in social groups. Those involved in conflict can deal with them by affiliation and interaction with one another. Many anthropoid primates reconcile conflicts which in turn decrease rates of selfdirected behavior such as self-scratching or self-grooming, a proxy of anxiety. Whether lemurs handle conflict in the same way is debated. We aim to address this question using over 1500 hours of observation on diademed sifaka (Propithecus diadema) and common brown lemurs (Eulemur fulvus) in the Maromizaha Protected Area, Madagascar. We test three hypotheses, (1) the rate of self-directed behavior increases directly after the conflict for animals involved, (2) the rate of selfdirected behavior of onlookers not involved in the conflict does not change, and (3) animals affiliate more after conflicts than during control periods. Preliminary results suggest that the rate of self-directed behavior increases after conflicts. Together, these results help clarify how lemurs deal with conflict as a part of the costs and benefits of social living.

# Does Early Life Behavior in Dairy Cattle Remain Consistent Across Time?

Vanessa Ostorga Sponsor: Cassandra Tucker, Ph.D. Animal Science

Dairy cattle perform abnormal repetitive behaviors (ARBs), like bar-sucking, in response to limited feed availability. These behaviors appear in early life likely due to frustration from a lack of natural suckling and foraging opportunities, and seem to vary among individuals. They are similar to ARBs performed in later life, despite differences in natural foraging behavior in this age class, suggesting these behaviors may continue undisturbed from early life. We aim to determine if cattle show consistent differences in performance of ARBs across time, suggesting a critical period for developing these behaviors. In 2019, 24 Holstein calves were raised with access to limited milk and adlibitum grain; half received additional ad-libitum hay. All calves were observed for 24h to measure performance of ARBs at weeks 4 and 6. In 2020, all animals were observed for 24h with feed restricted to 50% of previous intake; a common feeding strategy for this age class. We hypothesize that cattle who spent more time engaged in ARBs as calves will spend more time engaged in ARBs as heifers. We also anticipate consistent differences in the types of ARBs individuals perform as calves and heifers, indicative of personality.

# Developing a General Microalgae-based Photobioreactor for Removing Nutrients From Municipal Wastewater

Francesca Otim Sponsor: Ronald Tjeerdema, Ph.D. Environmental Toxicology

Harmful algae are documented agents of large-scale fish dieoffs in Los Angeles beaches. The algae, usually occurring as blooms, arise partly from increased amounts of nutrients coming from sources such as wastewater treatment plants entering the ocean and causing excessive algal growth. The consequences, referred to as eutrophication, range from oxygen depletion in water, to blocking sunlight from reaching organisms and to secreting chemicals toxic to sensitive organisms. It is therefore necessary to find ways to reduce nutrients reaching the ocean to save organisms sensitive to algal blooms. Recently, a proofof-concept microalgae-based system was shown to remove nutrients from wastewater released from a single wastewater treatment plant owned by the City of Los Angeles. Municipalities attempting this approach have failed to reap the full benefits of the system. The two questions we are asking henceforth are: 1.) Can our nutrient removal prototype system be faithfully adopted predictably through the year by the same plant? 2.) Do the chemical characteristics of treated wastewater from three other City-owned treatment plants obey the models developed with the prototype? For acceptance, our model needs testing and validation beyond one wastewater treatment plant.

# Technical Development and Assembly of a Modular Cubesat

*Mei Owens* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The REALOP CubeSat of the University of California, Davis team utilizes a new design that is modular and provides more access to internal payload components. To achieve ease of accessibility and modularity, the structures team designed mounting brackets and a unique printed circuit board (PCB) housing unit that are easy to modify and reorganize without having to take apart the whole satellite assembly. The assembly preparation team is currently working towards a standardized integration plan that carefully documents the process of assembling each payload component. A database of wellorganized and detailed documents was made to tackle the multiple challenges in developing an assembly procedure that independently integrated each of the critical payload components, PCBs, and wire routes with the structural frame. The assembly will consist of installing deployment switches, payload components and their respective mounting brackets, Xfaces, Y-faces, Z-faces, and finally solar panels. These new designs and standardized integration documents will be used for future CubeSat missions and testing.

#### Therapeutic use of IL-20 Neutralizing Monoclonal Antibody During Experimental Autoimmune Encephalomyelitis

#### Lisa Pacumio

Sponsor: Lillian Cruz-Orengo, Ph.D. VM: Anat Physio & Cell Biology

Multiple sclerosis (MS) is a chronic autoimmnune disease of the central nervous system (CNS). We can mimic some MS features in mice through induction of experimental autoimmune encephalomyelitis (EAE). Recent studies show that Interleukin-20 (IL-20) is a key player in inflammatory and autoimmune disorders. Using the EAE model we want to elucidate the putative contribution of IL-20 signaling in CNS autoimmunity. There exists a commercially available neutralizing monoclonal antibody (MAB) for IL-20 that has been successfully used in mice when delivered topically. We hypothesize that IL-20 neutralization will ameliorate EAE. We pursue this hypothesis with two aims: 1) MAB-IL-20 is safe to use in vivo, systemically, and 2) MAB-IL-20 will diminish progression of ongoing EAE. Our results using sham-immunized mice treated with either MAB-IL-20 or IgG control showed no sign of inflammatory hallmarks in tissues (skin, lung, gut, lymphoid organs and CNS) and plasma. We also found that EAE mice that started MAB-IL-20 treatment once they exhibited signs of neurologic impairment showed less EAE progression than EAE mice treated with IgG, suggesting MAB-IL-20 therapeutic effectiveness. By understanding the physiological implications of MAB-IL-20 treatment in EAE mice, we can further explore the feasibility of MAB-IL-20 treatment as disease-modifying therapy for MS.

# Social Development in a Rodent Model of Maternal Autoantibody Related (MAR) Autism

*Krithi Pai* Sponsor: Melissa Bauman, Ph.D. MED: Psychiatry & Behav Sci

Alterations in the prenatal immune environment are associated with an increased risk of autism spectrum disorder (ASD). Here we present a preclinical rodent model to investigate one potential cause of ASD - maternal autoantibodies targeting fetal brain tissue that are present in a subset of mothers of children with ASD. Although ASD is a uniquely human disorder, animal models can be used to study the effects of maternal autoantibody-related (MAR) autism on social development, which is typically altered in individuals with ASD. In this study, rat offspring exposed to MAR antibodies throughout gestation were compared to control offspring in a social dyad (SD). On post-natal day (PND) 36 (+/- 1 day), test rats (n= 56 MAR-treated, n= 28 control) were assigned to age- and sex-matched stimulus rats and tested together. Interactions were video-recorded and coded to assess social play behavior within each pair by observing the frequency of play behavior (nape attacks) during a 10-minute test. We hypothesize that MAR-treated rats will engage less in social play and exhibit a lower nape attack frequency compared to control rats. Studying the social play behaviors of MAR-treated rats will provide new insight into the neurobiological consequences of prenatal exposure to MAR antibodies.

Parmida Pajouhesh Sponsor: Audrey Fan, Ph.D. MED: Neurology

The sigma-1 receptor (S1R) has been found to be an important modulator of signaling mechanisms in pain and inflammation. and its expression is upregulated at regions of heightened nociception in the periphery. Indeed, whole body [18F]FTC-146 PET/MRI, a highly selective PET radioligand for the S1R, has shown increased uptake at sites of pain generation. Healthy asymptomatic volunteers and pain patients experiencing low back and pelvic pain were recruited. A GE SIGNA PET/MRI system was used for the whole-body PET/MRI scans consisting of eight to ten stations. The injection dose of [18F]FTC-146 was 10 mCi, and imaging of the brain began immediately after intravenous injection while imaging of whole-body (head-to-toe) began 40 minutes after injection. Corresponding static PET images and MRI scans were matched, normalized and referenced to the white matter region in PMOD 3.7. Sigma-1 receptor shows significantly (p<0.05) increased S1R radiotracer binding in precentral gyrus, cuneus, and insula; components of the brain 'pain matrix', which is a collection of neural centers involved in both physiological and cognitive aspects of pain processing. We can deduce that the expression of S1R in the brain plays a role in pain perception and central sensitization.

# Chemically-Gated and Sustained Molecular Transport through Nanoporous Gold Thin Films in Biofouling Conditions

Barath Palanisamy Sponsor: Erkin Seker, Ph.D. Elect & Comp Engr

Sustained release and replenishment of the drug depot are essential for the long-term functionality of implantable drugdelivery devices. This study demonstrates the use of nanoporous gold (np-Au) thin films for in-plane transport of fluorescein (a small-molecule drug surrogate) over large (mmscale) distances from a distal reservoir to the site of delivery, thereby establishing a constant flux of molecular release. In the absence of halides, the fluorescein transport is negligible due to a strong non-specific interaction of fluorescein with the pore walls. However, in the presence of physiologically-relevant concentration of ions, halides preferentially adsorb onto the gold surface, minimizing the fluorescein-gold interactions and thus enabling in-plane fluorescein transport. In addition, the nanoporous film serves as an intrinsic size-exclusion matrix and allows for sustained release in biofouling conditions (dilute serum). The molecular release is reproducibly controlled by gating it in response to the presence of halides at the reservoir (source) and the release site (sink) without external triggers (e.g., electrical, mechanical).

#### A Comparative Genomic Analysis of *Anopheles* gambiae and Anopheles coluzzii in African Oceanic and Lacustrine Islands

# Steven Palomares

Sponsor: Gregory Lanzaro, Ph.D. VM: Pathology, Micro, & Immun

In sub-Saharan Africa, Anopheles gambiae and An. coluzzii are the principal vectors of malaria, a deadly mosquito-borne disease caused by the parasite Plasmodium spp. These mosquitoes are closely related sister species in the An. gambiae complex that are morphologically indistinguishable. Population genomics has become a key component in differentiating An. gambiae mosquitoes and understanding their migration patterns. This species has a broad distribution spanning continental sub-Saharan Africa and surrounding African islands. Islands are model ecosystems for studying many species, including An. gambiae spp. mosquitoes. Their simplified biotas, small landmass, geological youth, and distance and isolation from the mainland make up the foundation of island biogeography theory which correlates these features with species richness and abundance. The aim of this study is the genetic characterization of An. gambiae and An. coluzzii island populations in terms of nucleotide diversity, effective population size, and demography, and their correlation with geological history and environmental features. A genomic data analysis will be conducted on individual whole genome sequences using a suite of bioinformatics tools. The generated data will be interpreted in the context of ecological and geological information assembled from existing island scientific literature databases.

# Identifying Trends in Research and Technology using Natural Language Processing

Zhengtong Pan Sponsor: Setareh Rafatirad, Ph.D. Engr Computer Science

This paper discusses the idea of using natural language processing to identify trends in technological research and development by extracting key terms and their semantic meanings from publication titles and text corpus. We processed the texts by training a Word2Vec model to extract key terms, or n-grams, from a text corpus composed of Google Scholar documents. The key terms are then correlated with temporal data and a label obtained from the Gartner's Hype Cycle for "Emerging Technologies" in order to identify trends between a technology's popularity and research and development progress. We select a classification model to classify the document's topic in a technological domain, and then use a time series model to predict the trend of a specific document within the technological domain. We present experimental results exploring the feasibility of developing a recommendation system to help guide researchers in selecting new technologies and domains for their research purposes.

#### Talking to Babies: Does What You Say Matter?

#### Grace Paniccia Sponsor: Katharine Graf Estes, Ph.D. Psychology

It seems instinctive for adults to use infant-directed speech (IDS) when speaking to infants-they raise their pitch, slow their speech, and exaggerate their intonation. Acoustic features have shown significant impacts on infant word-learning (Ma et al., 2011), but elaboration may also play a role. While a study has shown that repeating words facilitates word-learning (Maura et al., 2020), elaboration could also be important for language acquisition by exposing infants to the context of words. This study will examine the difference between repetition and elaboration of IDS and its relationship to infants' vocabulary development. Twenty American-English speaking parent-child dyads participated in a set of interactive tasks that contained objects labelled with target words. Audio recordings will be analyzed for the frequencies of target words spoken (e.g. cow) and additional descriptors used per object (e.g. "cows make milk"). We also collected parental reports of infant vocabulary size. We predict that infants whose parents use additional descriptors will have larger vocabularies than infants whose parents use more isolated repetitions of target words. We propose that elaborations are important because it diversifies word exposure. Understanding the role of repetition and elaboration in IDS is important because they may facilitate infant language acquisition.

# An *In Vitro* Investigation of Plant-Derived Prebiotics and Their Effects on the Ruminant Gut Microbiome

Yuna Park Sponsor: Matthias Hess, Ph.D. Animal Science

The ecology of the gut microbiome is associated with a multitude of metabolic and immunological processes that are vital to host health and function. In the livestock sector, there has been a growing interest in identifying compounds that target and modulate the gut microbiota to direct the gut metabolism towards more productive animals and, consequently, towards sustainable animal agriculture. For this project, we will be investigating four different plant-derived prebiotics for their potential to alter the composition and function of the microbial community in the rumen. To test our hypothesis that gut function and host health can be altered and improved by these compounds, we will utilize an artificial rumen system and determine changes in gas production ( $CH_4$  and  $CO_2$ ) in response to the addition of prebiotic compounds. Results from these engineered systems will enable us to identify the most promising candidates for subsequent in vivo trials without the need to expose animals to these compounds in the initial testing period. While results from this work will provide first insights into the health benefits of selected plant-derived compounds for improving the health and performance of ruminant animals, we plan to expand our work to include additional compounds and other gut systems.

#### Mehal Patel

Sponsor: Changil Hwang, Ph.D. Microbiology & Molec Genetics

Pancreatic cancer is the third leading cause of cancer death with a 10% of 5-year survival rate in the United States. This is largely due to early dissemination and late diagnosis. Recent studies suggest that pancreatic cancer metastasis can be driven by epigenetic factors, such as DNA methylation. DNA methylation occurs at cytosines, is catalyzed by DNA methyltransferases (DNMTs), and is associated with gene inactivation when at promoters. Reduced representation bisulfite sequencing experiments using organoid models of pancreatic cancer progression reveal that a number of gene promoter regions are hypermethylated in metastatic pancreatic organoids compared to paired tumor organoids, including Grb10. Grb10 encodes a growth factor receptor-binding protein whose overexpression has been shown to suppress growth. Because Grb10 is hypermethylated and downregulated in metastatic organoids, I hypothesize that hypermethylation of the Grb10 promoter is responsible for down-regulation of Grb10. Using the dCas9-DNMT3a fusion protein system to target specific cytosines with guide RNAs, I am specifically methylating the Grb10 promoter in pancreatic cancer tumor cells to analyze its effect on downregulation of gene expression and metastatic characters such as anchorage-independent growth and cellular migration/invasion. The results will likely provide further insight into the potential relationship between Grb10 and metastatic behavior.

# Psychoplastogens as Therapeutics for Alzheimer's Disease

Seona Patel Sponsor: David Olson, Ph.D. Chemistry

Alzheimer's Disease (AD) affects nearly 6 million Americans but there are currently no effective therapeutics to stop or reverse the progression of this disease. Neuronal atrophy and the formation of amyloid-& plaques in the cortex and hippocampus play a key role in the pathophysiology of AD, resulting in severe impairment in memory and cognition. The Olson Lab has demonstrated that psychoplastogens-compounds capable of rapidly promoting structural and functional neural plasticity— can counteract retraction of neurites and loss of dendritic spines and synapses through activation of growth and survival pathways. In this study, our overall objective was to assess the efficacy of psychoplastogens and non-hallucinogenic analogs in cellular models of AD. Through biochemistry and molecular biology assays used to measure dendritic arbor complexity, spine density, and cell viability, our results show that psychoplastogens reduce dendritic atrophy caused by amyloidß 1-42 oligomers (Aß1-42), and treatment increases the resilience of these cells to A
ß1-42 insult. This demonstrates that psychoplastogens may be a novel therapeutic strategy for the treatment of this common and devastating disease.

# Bhakti Patwardhan Sponsor: Camelia Hostinar Caudill, Ph.D. Psychology

Although children's emotion regulation is related to parental behaviors and perceptions, existing evidence is mixed (Meyer et al., 2014; Shannon, 2011). This study investigates the link between parent perceptions of child emotion regulation and parenting. One-hundred and nineteen children (x? age = 9.9, SD = 0.58, 49.6% female) were randomized into two groups: receiving parent support before a modified Trier Social Stress Test (TSST-M) (N = 56), or preparing alone (N = 63). Parents completed the Emotion Regulation Checklist (ERC) about their child and were videotaped during the preparation. Following the TSST-M, children rated their state anxiety (STAI-C) and how helpful their parents were. ERC was negatively correlated with STAI-C, r(117) = -.25, p = .01, but not with observed parent validation (r(54) = .11, p = .42) or involvement (r(54) = -.12, p = .37). There were no significant gender differences (p-values > 0.20). Parents' perception of how well their child regulates emotions was consistent with children's reported stress, but not related to parenting behavior during preparation period. ERC was positively correlated with children's ratings of parenthelpfulness, r(60) = .41, p = .001, suggesting parents enlist different types of encouragement based on their perception of their child's emotion regulation.

# CAMPFIRES, COURTSHIP, AND COVERED WAGONS: THE SOCIAL AND CULTURAL WORLD OF THE OVERLAND TRAILS

Joy Pedersen Sponsor: Rachel St John, Ph.D. History

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

# *Lilian Pelattini* Sponsor: Brian Trainor, Ph.D. Psychology

Anxiety disorders are characterized by behavioral inhibitions such as increased arousal and social avoidance. The underlying mechanisms for these behaviors are unknown and many individuals do not respond to current treatments. Because social anxiety is more prevalent in women, our studies use the California mouse social defeat model that induces several anxiety-like symptoms in females versus males. During social interaction, stressed female California mice orient towards an unfamiliar mouse without approaching it, a behavior defined as social vigilance. In contrast, social approach is when a mouse interacts with an unfamiliar mouse. In this project, we examined the mechanisms of these responses and their relation to behaviors in other contexts. A stressed mouse is acclimated to a novel cage and a same-sex juvenile mouse is then introduced. Stressed female mice showed an increase in autogrooming when transferred to a new cage, which is expected as this occurs in the social defeat model. The stressed females also showed higher levels of freezing, a behavioral response to a perceived threat, after the juvenile female mouse was introduced. We found that autogrooming, not freezing, is positively correlated with social vigilance. These results suggest that circuits modulating social approach and social vigilance are distinct.

# The Influence of Climate Variables and Disease on *Plantago lanceolata* Survival

### Sophia Pelletier Sponsor: Jennifer Gremer, Ph.D. Evolution & Ecology

This project is a continuation of a study on the globallydistributed perennial plant Plantago lanceolata that has been conducted annually since 2016. Studying global P. lanceolata populations in relation to climate change helps to inform the development of persistence models. The protocol of Plant Pop Net, an international project, was used to execute our study. Plant Pop Net aims to comprehend the factors driving the spatial dynamics of plant populations in response to climate change using data from P. lanceolata populations around the globe. At our site in Davis, CA, we measured the abundance and phenotypic traits of P. lanceolata for five years. Data collected includes leaf length, inflorescence length, disease presence, and other phenotypic traits. We would like to investigate the influence of climate variables and disease on plant survival. Using compiled data, we will look at variation in precipitation and temperature to see if there is a correlation with yearly plant survival. In addition, yearly survival will be compared to the proportion of plants containing disease. We predict that individuals with disease will experience reduced survival compared to those without. Further, we expect higher precipitation and temperature to result in increased survival.

# The Burden of French Multiculturalism

#### Mazarine-Claire Penzin Sponsor: Jeannette Money, Ph.D. Political Science

To better understand the impact of laïcité (secularism) and its policies on French minorities, this paper traces the effects of tightening secular policies on the minority experience in French society, specifically for French Muslim women. From work done by Aala Abdelgadir and Vasiliki Fouka (2020), there already exists an established connection between the 2010 French secular law banning the wearing of the nigab and the experiences and feelings of Frenchness of minorities in France. This paper takes the research a step further, looking at secular legislation in France from 1989 to 2010 and tracing their direct and indirect effects on the Muslim experience in France by analyzing two main channels of effects: the disrcimination channel and identity channel. While the assessment of the data sets are still in progress, current findings seem to suggest that impacts of the legislation has increased over time as a result of secular policies becoming more severe. Such findings are crucial for determining whether France's approach to its society's multiculturalism has had adverse effects on its population, and if a new course of action should be adopted by policymakers.

# Activated BHB Species Capable of Post-Translational Modification of Proteins via BHBylation

Sawyer Peralta Sponsor: Keith Baar, Ph.D. MED: Physiology & Membrane Biol

Ketogenesis involves the metabolism of fatty acids to produce ketone bodies: circulating energy carriers that can substitute for glucose to provide cellular energy under conditions such as fasting, exercise, or low carbohydrate intake. Ketogenesis has been associated with various health benefits in rodents including extended lifespan, reduction in cancer progression, and improved memory. BHB is the most abundant ketone body in mammals and can post-translationally modify proteins by a process known as BHBylation, which affects protein function. Similar modifications, such as acetylation, are controlled by acyltransferase enzymes but can occur non-enzymatically as well. The molecular mechanism underlying BHBylation of protein lysines is not vet characterized. This project aims to determine whether BHB can non-enzymatically modify proteins. Human serum albumin (HSA) was incubated in vitro with varying amounts of three BHB species (BHB-Na+, BHB-CoA, and BHB-SNAC) under physiological temperature and pH for increasing incubation periods. Samples were analyzed via Western blots using a primary antibody against lysine BHBylation. My results showed a time- and dose-dependent increase in non-enzymatic BHBylation with the activated thioester species BHB-CoA and BHB-SNAC, but not with BHB-Na+. These results indicate that thioester forms of the ketone body BHB can non-enzymatically BHBylate lysine residues.

#### Examining the Quantitative Extent of DNA Metabarcoding for San Francisco Estuary Species Monitoring Using a Mock Community

# Serra Perry Sponsor: Andrea Schreier, Ph.D. Animal Science

The San Francisco Estuary (SFE) is a biodiverse and ecologically significant habitat presenting the need for early detection of potentially invasive species such as zebra mussels, and monitoring of listed or rare species such as delta smelt. A suggested management method is environmental DNA metabarcoding which simultaneously identifies genetic material of species in environmental samples using primers. Primers isolate identifying regions of DNA called barcodes to amplify for sequencing. However, mismatches between primers and DNA templates influence relative sequence read abundance and can lead to altered taxon representation. This project investigates whether species abundance in the SFE can be estimated with sequence abundance given primer bias potential. This experiment will create a mock community mostly of fish, but including molluscs and crustaceans analyzed using different primer sets. This can demonstrate metabarcoding's effectiveness as a qualitative measure for species abundance complementary to government agency monitoring. Based on published evidence suggesting environmental DNA can be quantitative in lakes and in deep ocean waters, there is potential for the SFE to express a correlation between sequence and species abundance. Mock community sequencing to quantify primer biases will help increase the accuracy of environmental DNA metabarcoding for species monitoring in the San Francisco Estuary.

# Assessing the Development of Visual Short-Term Memory in the Preschool Period Using an Online Change-Detection Task

*Van Pham* Sponsor: Lisa Oakes, Ph.D. Psychology

Visual short-term memory (VSTM) is the ability to briefly store and maintain visual representations during disruptions in information that occur during eye movements and blinks. The current study examines VSTM during the preschool period using a change detection task on an online testing platform (Gorilla.sc). In change detection, participants are presented with a sample array containing several different colored squares, followed by a delayed period (during which they have to remember the sample items), and finally a test array containing the previously presented items and one or more changed items. Infants demonstrate their VSTM for the items in the sample array by looking longer at the changed items to the non-changed items in the test arrays (Oakes et al., 2013). We adapted this task and tested fifty 12- to 48-month-old children. Ongoing analyses will provide insight into (1) how VSTM develops from infancy through early childhood and (2) whether we can detect VSTM in children using an online platform.

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

#### *Megan Phelps* Sponsor: Gwendolyn Arnold, Ph.D. Environmental Science & Policy

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

# Investigation of a Potential Neural Bases of Tinnitus in Rhesus Macaques

*Diana Polhac* Sponsor: Gregg Recanzone, Ph.D. Neuro Physio & Behavior

Aging affects the structural integrity of the brain required for processing sound. Tinnitus, characterized by phantom sounds, is most common in people with age-related high frequency hearing loss. Symptom severity ranges from a nuisance to the impairment of daily activities. Classic studies in young cats with cochlear damage revealed that the representation of large areas of primary auditory cortex that were previously responsive to high frequencies reorganized to become responsive to the highest frequency that the animal could still hear. This cortical reorganization has been hypothesized to be the underlying neural substrate of tinnitus, as the phantom sound is also at the highest frequency that the person can still hear. I therefore investigated neural activity differences between reorganized and non-reorganized auditory cortex regions in an alert, geriatric male macaque with age-related hearing loss. I compared neural activity of a 26-year-old monkey to tone stimuli of different frequencies and durations using standard extracellular recording techniques. Stimuli were presented at the frequency that the recorded neurons responded best to for 0.1, 1, 10, and 100 seconds. Preliminary results indicate significant changes in spectral, temporal, and duration effects between normal and reorganized cortex across the primary, core, and belt auditory cortical regions.

# *Elizabeth Polston* Sponsor: David Begun, Ph.D. Evolution & Ecology

While previous research has investigated genes that are differentially expressed (DE) between populations, sexes, species, and tissues, little work has simultaneously characterized evolution of expression across multiple levels of analysis. Using recently publicly available RNA-seg data from multiple species, sexes, and tissues in Drosophila, I aim to identify previously unknown patterns of transcriptome divergence in this clade. I have used bioinformatics software to identify DE genes in three Drosophila species for both sexes in two tissues. Now, I plan to compare the direction and patterns of expression in this clade using genes present in all three species. Preliminary results show that for each species, proportions of DE genes for each individual sex and tissue comparison is similar. Additionally, comparisons for male and gonad tissues always had higher counts of DE genes regardless of whether they diverged in the direction of gonad/reproductive or male/female respectively. Further analysis will include analyzing the significance of these differences. These results will be widely applicable within Drosophila research and, more generally, genetics research because examining multiple levels of biological differences within an evolutionary framework is novel in this field.

#### Evolutionary and Sequence Analysis of Putative Genes Associated with Nitrogen Use in Wheat

Yan Pomogov Sponsor: Diane Beckles, Ph.D. Plant Sciences

Wheat provides 20% of the calories consumed by humans and is grown on almost every continent on earth. Nitrogenous fertilizer is used to promote wheat yield and quality, but it is expensive, and harmful to the environment, contributing to greenhouse gases and eutrophication of natural waterways. Therefore, improving nitrogen use efficiency (NUE), i.e., the proportion of nitrogen taken up from the soil and converted to wheat biomass is important. Through QTL mapping, a region of the wheat genome potentially associated with NUE was discovered. Some of the genes in this region may be related to nitrogen and nutrient uptake: however, they have not been characterized or, have not been studied in wheat. In this work, we will perform a full bioinformatics analysis of three candidate genes in this region. Evolutionary, sequence and protein analyses will be performed using an array of available tools. These data will build a foundation of the important information needed to help prioritize the genes for functional in-lab testing, to determine their potential contribution to NUE in wheat.

#### Maura Ponce Sponsor: Damien Caillaud, D.V.M.,Ph.D. Anthropology

Human activities contribute to the decline of many wildlife species by exploiting and extending increasingly further into wild habitats. In the case of primates, some species have been able to adapt to human disturbance by being able to live in urban areas, while other species only occur in non-urban areas. The objective of this study is to investigate factors allowing some primate species to live in urban areas. We used data from primary literature, compiled in the Primate Social Behavior and Conservation database from the Caillaud lab. We collected data for fifty-four urban primate species and an equivalent number of non-urban species. We analysed our data usina phylogenetically controlled statistical tests and compared group size, activity budget, and dietary composition between urban and non-urban species. Preliminary analyses suggest that species in urban areas tend to live in smaller groups, spend a higher percentage of their activity budget feeding and foraging, and have a more generalist diet compared to control species in non-urban areas. The results of this study should be considered in future conservation efforts for urban and non-urban primate species.

#### Impact of Imposter Syndrome on University Honors Transfer Students

Bethany Ponte Sponsor: John Furlow, Ph.D. Neuro Physio & Behavior

The importance of this research is to understand the impact that a University Honors Program (UHP) at an RI university has on transfer students and their perceptions of imposter syndrome. The hypothesis is that many students will be affected by imposter syndrome in the University Honors Program by having a fear of failure in the classroom and diminished involvement on campus. The Clance Imposter Scale survey, that included questions such as their perceptions on being successful or not belonging in their academics, was completed by a sample of 4th-year transfer students in the UHP program. The students with survey scores over 60, indicating the benchmark for imposter syndrome, were invited to an hour interview that discussed their process of being accepted to the UHP program and the ways that they became involved in their program. Data analysis is underway and will be completed by the time of the conference. I anticipate that this study will find that transfer students lack a perception of acceptance and belonging when going to a large research university. Institutions and programs would benefit from supporting high achieving transfer students as they pursue their education, as they are a large portion of the student population.

#### Investing in Gentrification: The Eligibility of Gentrifying Neighborhoods for Federal Place-Based Economic Investment in U.S. Cities

# *Amanda Portier* Sponsor: Noli Brazil, Ph.D. Human Ecology

Place-based policies aim to increase neighborhood economic well-being in disadvantaged areas through job opportunities, business development, or affordable housing. Policymakers attempt to target the most disadvantaged areas using socioeconomic criteria to determine if a neighborhood is eligible for program benefits. Selecting the most economically distressed neighborhoods for program eligibility ensures that the program aids those most in need. However, the selection criteria may not be successful in doing so. In this study, we examine the relationship between neighborhood gentrification status and 2018 eligibility for the following four federal placebased programs in U.S. cities: New Markets Tax Credits, Opportunity Zones, Low Income Housing Tax Credits, and the Community Development Financial Institution Fund. Our results indicate that large proportions of gentrifying neighborhoods are eligible for each program with many neighborhoods being eligible for multiple programs. The Opportunity Zone program is distinct as the probability of eligibility is nearly twice as high for gentrifying tracts than non-gentrifying tracts. We also find that the probability of program eligibility increases as the proportion of adjacent neighborhoods experiencing gentrification increases. Our findings suggest that the program eligibility criteria, most significantly with the Opportunity Zone program, does not always select the most economically disadvantaged neighborhoods.

# Functional Analysis of Female and Male Medfly Hazard Functions

Camden Possinger Sponsor: Hans-georg Mueller, M.D.,Ph.D. Statistics

One of the greatest mysteries that humankind has ever tried to solve is longevity. Why do some live shorter and some longer? Can we do anything to prolong our longevity? In this ongoing study, I analyze the differences between a collection of male and female hazard functions to identify distinct characteristics and potential interaction effects. After an initial exploratory analysis, we discovered that at the end of a fly's lifespan the probability of death was more variable for males than females. Furthermore, we hypothesized that there may also be a significant interaction effect between these two. A formal analysis of these and possible other observations will be conducted using Functional Concurrent Regression and by obtaining the Functional Principal Components from our sample data. If significant findings are found the results will contribute new knowledge about this model species and help future studies evaluate differences in male and female medfly aging more effectively.

### Vishwanath Prathikanti Sponsor: Ozcan Gulacar, Ph.D. Chemistry

Questions in assignments for students are often grouped by chapter, topic, or concepts. The structure shows a great emphasis on categorization. Practice problems in chemistry textbooks are mostly organized by sections to help students navigate the assignments and practice in order; however, exams usually test students with problems from a series of chapters in a mixed format. Therefore, there is a mismatch between what students practice on and how they are tested. The goal of this study is to examine the structure of the assignments on students' problem-solving performances. The study uses scientific control method and divides students into two groups throughout three experiment sessions. Each group had interventions with same length and identical questions but different structures. The experimental group had mixed questions, while the control group had questions organized based on chapters and topics. This study is critical in studying students' learning abilities with mixed and categorized problems. The findings could help UC Davis instructors to better structure their teaching materials to help improve students' problem-

solving abilities. Given most textbooks and instructors tend to organize and classify content for students to navigate the knowledge base, this study is important to assess the effectiveness of the traditional teaching method.

# Parent-child emotion talk and its link to children's emotion regulation: A cross-cultural comparison between Mexican-American and Chinese-American families

*Jia Lei Qiu* Sponsor: Yuuko Tonkovich, Ed.D. Education

Past studies have shown that parents' openness in emotion talk (ET) with their child can facilitate a stronger sense of control in the child's emotion regulation (ER). ET is the use of emotion language (e.g. emotion words, emotion questions) and plays a crucial role in socializing emotion understanding and behaviors. ER encompasses all processes in monitoring, understanding, and modifying one's reactions to the outside environment in an effort to accomplish one's goals. However, there is less research with families of diverse cultural backgrounds. To address the gaps in previous research, this study examines differences in cultural groups and the associations between ET and children's ER with Mexican-American (MA) (N=46) and Chinese-American (CA) (N=44) families from Head Start. Parents were asked to read a picture book, "Frog, Where Are You?" to their child. Children's ER was assessed by the Transparent Box task, a frustration eliciting task. Preliminary results show significant differences in ET between MA and CA parents with MA parents showing more ET than CA parents. Preliminary findings also show associations between parents' negative words and child's persistence during the Transparent Box activity. These results suggest possible cultural differences. Implications will be discussed.

#### Relations on the Mapping Class Monoid

#### Victoria Quijano Sponsor: Laura Starkston, Ph.D. Mathematics

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

#### Infant Motor Development Influencing Visual Preference

### Franchesca Quintero Sponsor: Lisa Oakes, Ph.D. Psychology

Infants are incredibly adept learners, possessing the ability to gather pertinent environmental information about the world and how it works. This study investigates the relationship between an infant's access to information, in the form of motor development, and their visual attention to objects with complex features. Research has shown a robust link between infant experience manipulating objects and their visual attention to object properties. In the present study, 4-12-month-old infants (N = 100) were shown pairs of unfamiliar objects. One object was easily "graspable", with a handle-like region, specialized for grasping, while the other was not. Additionally, parents completed a motor development questionnaire about their infant's motor abilities. All data were collected through the Lookit online platform and coded with Datavyu software for the duration of looking at both objects. We hypothesize that increasingly complex motor capabilities, such as crawling or walking will influence the features of objects that infants find most interesting. Thus, an infant with motor ability that allows for object obtainment and manipulation will show a visual preference for objects with specialized features, such as handles.

#### Better with Time? The Effects of Parental Experience and Age on Prolactin Regulation in the Brain of a Biparental Bird

Alison Ramirez Sponsor: Victoria Farrar, Ph.D. Neuro Physio & Behavior

As animals age and gain parental experience, they present a faster onset of parental behavior towards young. Various hormones underlie the transition into parental care and may differ in levels between inexperienced and experienced parents. Prolactin, a hormone famous for its role in milk production in mammals also drives parental care behavior in vertebrates, including birds. While previous studies conducted show how prolactin levels affect parental care behaviors in inexperienced and experienced individuals, it is unknown whether sensitivity to prolactin changes in the brain. Thus, this study will examine the separate effects of age and parental experience on prolactin responsiveness in the brain by measuring gene expression. To address this, we collected brain tissue from the rock dove (Columbia livia), as both sexes of this bird present prolactin-driven parental care behavior. We will assess the amount of prolactin receptor genes expressed in doves with varying levels of age and experience using quantitative PCR. We hypothesize that experienced parents will have more sensitivity to parental hormones, therefore displaying a higher level of prolactin receptors. These results will provide us with a deeper understanding of the neural changes occurring in the parental brain as animals gain reproductive experience while controlling for age.

# Real-time microscopic imaging of hCTPS interactions with organelles and cytoskeleton.

Yaniel Ramirez Sponsor: Enoch Baldwin, Ph.D. Molecular & Cellular Bio

The human intracellular cytosine triphosphate (CTP) pool is subject to tight regulation because it can limit cellular growth and proliferation. In humans, Cytidine Triphosphate Synthetase 1 and 2 (hCTPS1 and 2), catalyze the rate-limiting step of de-novo CTP biosynthesis. In all organisms studied, different hCTPS enzyme conformational states are reversibly sequestered into micron scale polymeric filaments that alter enzyme activity or allosteric properties and are critical to regulating hCTPS output. In human MCF10A cells expressing fluorescently-tagged hCTPSs, these filaments appear as two distinct pools, smaller "punctae" and larger "rods". Both forms are dynamically transported and localized which suggests that their cellular locations are important to their function. We hypothesize that sequestering dynamically transported punctae and rods focuses hCTPSs activity to sub-cellular regions and further contributes to their regulation. This hypothesis predicts hCTPS associations with cellular components. To define these associations more precisely, we will use CellLight® reagents to RFP-tag target intracellular structures in MCF10A human breast cells expressing both hCTPS1-CFP and hCTPS2-YFP. Subsequently, 2-D confocal and 3-D high-resolution fluorescence microscopies will be utilized to identify organelles that interact with puncta and rods, as well as cytoskeletal components that mediate their transport and localization in real time.

#### The Effect of Information Value on Attentional Guidance is Proportionate to the Perceived Variability of the Stimulus

#### Arya Ranadive Sponsor: Joy Geng, Ph.D. Psychology

Our environment is complex and dynamic, making it critical for observers to determine what information in the environment is important for achieving their goals. In this study, we tested whether attention is moderated by the perceived reliability of information used to predict upcoming stimuli. During trials, participants were presented with a cue and then searched for the object most similar to the cue, called the target. The cue had a specific orientation, which indicated the most likely orientation of the target, and color, which indicated the reliability of the orientation information. The reliability was manipulated by using a Gaussian distribution with low, medium, or high variance. After each block, participants rated how informative the cue was during search. The data replicated previous results showing that as the reliability of the cue increased, the effect of target orientation on search increased (t(59)=3.23, p<.01). Additionally, we show that individuals that perceive a greater difference in cue reliability also showed a greater difference in the effect of cue to target orientation difference for different cues (pearson r = .254, p <.05). These results suggest that participants' individual perception of information reliability moderates attention for predicted upcoming stimuli.

# Exploring the Bioclimatic Distribution of a Worldwide Plant Pathogen

Heera Rasheed Sponsor: Daniel Kliebenstein, Ph.D. Plant Sciences

Botrytis cinerea is a pathogenic fungus that forms a gravish mold that infects a wide range of plants. It creates a devastating financial loss for vegetable, fruit, and ornamental plant growers. Botrytis thrives in cool and wet spring and summer weather, usually around 15-25?. Although Botrytis is a widespread plant pathogen, its genetic diversity and bioclimatic distributions are not well documented at a large scale. To address those distributions, the lab created a database of more than 9000 strains. The database is a combination of a meta-analysis of strains of 48 studies describing strains of Botrytis from different regions of the world, and the global weather and climate data from the WorldClim dataset. The variables include the host species and extreme or limiting environmental factors, specifically the temperature of the coldest and warmest month, and precipitation of the wet and dry guarters. Such metaanalysis dataset provides an avenue to explore questions on the susceptible hosts, the critical times and climatic conditions for Botrytis infection using data analysis and statistical tools such as R.

# Caffeine Biodegradation and Chemotaxis Response by Methylorubrum populi strain PINKEL

*Alycia Rasmussen* Sponsor: Rebecca Parales, Ph.D. Microbiology & Molec Genetics

Caffeine is widely consumed in food products and beverages and is used as an active ingredient in some medications. Many aquatic environments are experiencing caffeine pollution, which is drastically affecting the balance of ecosystems. Previous research indicates that bacterial chemotaxis-the directed movement of cells toward an attractant or away from a repellent -enhances the biodegradation of chemicals. Therefore, understanding how bacteria sense and degrade caffeine and its degradation intermediates is important for applications in the food, medical, and bioremediation industries. The Parales laboratory has been studying caffeine degradation by Methylorubrum populi strain PINKEL, which was isolated from compost by selective enrichment for growth on caffeine. Strain PINKEL is a facultative methylotroph that can use caffeine as its sole carbon, nitrogen, and energy source. Recent work in the laboratory has shown that strain PINKEL is significantly more efficient at caffeine degradation than other caffeine degrading bacteria, such as Pseudomonas strains, and displays a chemotactic response to caffeine. Our aim is to use PINKEL and its caffeine catabolizing enzymes for decaffeination and bioremediation of caffeine-contaminated environments by first carrying out a detailed characterization of the chemotactic response to caffeine by strain PINKEL.

# Chlamydomonas Reinhardtii as a Sustainable Platform for Recombinant Insulin Production

Jasmine Rattanpal Sponsor: Marc Facciotti, Ph.D. Biomedical Engineering

As the demand for medicine continues to grow, current methods of therapeutic protein production can be expensive and unsustainable. Our project aims to genetically engineer Chlamydomonas reinhardtii to produce the mini-insulin recombinant protein in an effort to make medicine production sustainable and cost effective. C. Reinhardtii is a single-celled eukaryotic algae whose chloroplast is capable of producing therapeutic-grade proteins. Because C. Reinhardtii is relatively inexpensive and only requires sunlight, low-filtration water, an inexpensive buffer, trace minerals, CO2 and a nitrogen source to survive, it is an ideal platform for inexpensive protein production compared to current methods. We report our progress towards investigating the potential of C. reinhardtii as a protein production platform, and our progress towards genetic construct design and algal strain engineering with miniproinsulin as our primary candidate protein. Currently we are designing our protein purification protocol for when we return to the lab in person. The Algae to Insulin Project is part of BioInnovation Group, which is one of the first undergraduaterun research organizations at UC Davis providing undergraduate students with collaborative and innovative research experience.

The rate of neurogenesis rapidly declines as humans age, limiting our ability to recover from nervous system injury. Thus, understanding the genetic control of neurogenesis is essential in developing effective treatments for human neurological disease. The freshwater cnidarian Hydra vulgaris can quickly and accurately regenerate its entire nervous system after injury and many Hydra neural genes are conserved in vertebrates, making it an excellent model to study neurogenesis. Hydra's nervous system is composed of two nerve nets, one located in its outer epithelium (ectoderm) and one in its inner epithelium (endoderm). Our lab has developed a molecular map of the Hydra nervous system, which includes 12 neuronal subtypes, three of which are in the endoderm. I aim to 1) define the structure of the endodermal nervous system, and 2) characterize the regulatory elements necessary to build each endodermal subtype. To do this, I will create transgenic reporter lines for each neuron subtype. I will then use fluorescenceactivated cell sorting (FACS) to isolate transgenic neurons, followed by ATAC-seq to identify regulatory elements underlying endodermal neuron specification. My work will result in a complete structural and regulatory characterization of the endodermal nerve net, allowing for insights into Hydra nervous system regeneration.

### Incidental Findings found on Abdominal Imaging performed for General Surgery Patients

Rafael Emilio Ricon Sponsor: Michael Campbell, M.D. MED: Surgery

The use of computerized tomography (CT) imaging has increased, leading to a rise in the identification of incidental findings (IF). Inappropriate follow-up of IFs can lead to poor patient outcomes, delayed treatment and increased costs. The rate of patient awareness and follow-up of IFs has not been evaluated in patients admitted to an acute care surgery (ACS) service. We conducted a review of ACS patients with a primary care provider (PCP) admitted from January 2014 to December 2019. The aim of the study was to evaluate the incidence and rate of appropriate follow-up of IFs. 2047 patients met inclusion criteria and 163 (8%) were included in this interim analysis. 80 (49%) patients had a PCP. 30 (24%) patients received additional follow-up of their IF. Of the patients receiving follow-up, 9 (30%) had a recommendation for follow-up highlighted in the report of their index CT scan. 48 (60%) patients had the IF included in their discharge summary. 16 (53%) were referred to a specialist, with (2) 3% of patients ultimately having a life-threatening IF. IFs are common in the ACS population. Despite efforts to inform patients of their IF, the majority of ACS patients do not receive recommended follow-up.

#### *Robert Ridgley* Sponsor: Adam Zientek, Ph.D. History

On the afternoon of May 21, 1871, the Paris Commune began to collapse. The French Army finally infiltrated Paris and started massacring the Communard revolutionaries that seized the city two months earlier. Amidst the bloodshed, a rumor circulated. French bourgeoisie wrote and published fabricated stories of 8000 female revolutionaries that crept throughout Paris and lit it aflame. While false, these accounts of wretched pétroleuses (female fire-starters) spread throughout France and reaffirmed popular beliefs that when women involved themselves in politics, they became unruly, violent, and dangerous. This thesis examines the myth of the pétroleuses in the late nineteenthcentury United States. During the fall of the Paris Commune, American media published the fabricated accounts of women arsonists and spread the myth throughout the country. Conservative leaders and newspapers then weaponized the myth of the pétroleuse against women's rights and feminist reform. Just as in France, the pétroleuse came to represent the danger of women leaving the household and entering the public sphere—for allowing women to participate in politics resulted in liberty, equality, and inferno.

# Design and Implementation of a Video Game to Teach Programming to Non-Technology Majors

Daniel Ritchie Sponsor: Darnel Degand, Ed.D. Education

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

### Investigating the Role of PLCE1 Risk Variants on the PI3K/Akt Pathway in Gastric Cancer

Sienna Rocha

Sponsor: Luis Carvajal-Carmona, Ph.D. MED: Biochem & Molecular Med

Genome-Wide Association Studies (GWAS) have identified a large number of genomic variants, specifically single nucleotide polymorphisms (SNPs), associated with increased risk for Gastric Cancer (GC). Three of these risk SNPs (rs2274223, rs3765524, and rs1050970) are located within the PLCE1 gene. PLCE1 encodes a phospholipase enzyme that has been shown to function within the PI3K signaling cascade, a commonly dysregulated pathway in cancer. However, the effect of these variants on PLCE1 function and GC risk remains unexplored. In this study, we utilized TCGA GC patient data to correlate rs2274223, rs3765524 and rs1050970 genotype with tumor mutation frequency of genes within the PI3K/Akt pathway. We also explored the association of these risk SNPs with recently published molecular subtypes of GC (Epstein-Barr Virus positive, microsatellite instable, genomically stable and chromosomal instable). Finally, we generated in vitro models of risk SNP rs2274223 which results in a Histidine to Arginine amino acid substitution to assess its effect on PLCE1 function. Our study provides a critical evaluation of the role of PLCE1 GWAS-risk variants in GC development for application in patient treatment and prevention.

# The Impact of A-G Reform

### Cecilia Rodarte Sponsor: Giovanni Peri, Ph.D. Economics

Getting more students to obtain a higher education has been a goal in the United States for many years. In order for students to successfully obtain a college degree they also have to be prepared for the rigor of college level courses. In an effort to ensure that students graduating high school are academically prepared for college, some districts across California have incorporated the A-G requirements to their high school graduation requirements. The A-G requirements are courses in seven different subject areas that are required to be completed with a grade of a "C" or better in order to be eligible to attend a four-year public university in California, such as a University of California (UC) or a California State University (CSU). Luse school-level data from the California Department of Education and an event study design to look at how this change in graduation requirements has impacted high school graduation rates and the successful completion rates of the A-G requirements, that is with a grade of a "C" or better. I also explore the relationship between this policy and college enrollment rates using a cross-section regression.

# Sex Differences in the Peripheral Blood Gene Co-Expression Networks Following Human Intracerebral Hemorrhage

# Fernando Rodriguez Sponsor: Boryana Stamova, Ph.D. MED: Neurology

Intracerebral Hemorrhage (ICH) stroke is caused by bleeding from a burst artery within the brain. The peripheral immune system has been implicated in ICH response. Since there are extensive sex differences in the immune system, we investigated the sex differences in the peripheral blood immune response following human ICH. Thus, we performed wholetranscriptome analysis of peripheral blood from 48 male and 18 female subjects split evenly between ICH and vascular risk factor controls (VRFC). We conducted separate Weighted Gene Co-Expression Network Analysis (WGCNA) which revealed 2 significant gene co-expression modules (of 40) (p<0.05) in male ICH, while 5 significant gene co-expression modules (of 29) in female ICH. Common biological processes (n=8) affected both in male and female ICH (Benjamini-Hochberg corrected p<0.05) included innate immune response, blood coagulation, and Fc- $\gamma$ receptor signaling involved in phagocytosis. Female ICH subjects had more biological processes specific to them (n=164) compared to the number of bioprocesses associated with male ICH (n=36). The female-specific bioprocesses included T-cell related pathways, NF-Kß signaling, and RAGE receptor binding, while the male-specific ones included immunoglobulin receptor binding, Fc-e, and B-cell receptor signaling pathways. The findings underscore the significance of further investigating sexdifferences and sex-specific treatment targets leading toward personalized medicine.

# Do GRE scores predict Graduate school success for Communication students?

*Mercedes Ross* Sponsor: Richard Huskey, Ph.D. Communication

The GRE exam is used to predict how well students will do in graduate school. The strongest evidence to support this prediction is during the students first year of graduate school and after that the evidence is unclear. Minority applicants tend to score lower on the exam than white and Asian applicants and this disparity in scores means that minority applicants are systematically disadvantaged in graduate school acceptance. A number of factors make it difficult for minorities to take the GRE exam and the current online format is another hurdle. Our goal is to determine if the GRE is useful for predicting graduate school success for Communication students. We will collect data on undergraduate GPA. GRE scores, graduation rate, race, age and gender from all the institutions that grant PhDs in Communication within the United States listed on the NCA Program Guide. Once the data are gathered, we will assess if the GRE scores predict graduate school success in Communication PhD programs. If the scores prove to be valid predictors of success, then graduate schools should continue to use them. If not, then graduate schools may be more supportive of minorities by adopting more holistic forms of application review.

#### Evaluating Cultural Destruction Jurisprudence through Criminal Response, Restorative Response, and Regulatory Process Perspectives

# Devapriya Roy

Sponsor: Keith Watenpaugh, Ph.D. Religious Studies

Cultural heritage has a tenuous relationship with international humanitarian law. This thesis assesses the current state of international legal structures that exist to protect cultural heritage in times of conflict and formulates why cultural destruction should be treated as a consequential human rights issue. I lay out the history and conception of cultural genocide and destruction in human rights theory, before evaluating the three approaches that have been taken to address the destruction of culture: the criminal response, restorative response and regulatory process. In the criminal response section, I analyze the International Criminal Court's role in protecting cultural heritage. I utilize The Prosecutor v. Ahmad Al Fagi Al Mahdi-the first case where the ICC imposed a sentence for attacking cultural heritage-and other cases to conceptualize this approach. In the restorative response section, I explore post-Holocaust legal restitution efforts through existing literature, paying special attention to looted art. Finally, in the regulatory process section, we see cultural heritage being conceptualized as matters of property law and subject to repatriation. I use the Native American Graves Protection and Repatriation Act as a case study to explore subsequent litigation and the steps taken to protect indigenous cultural property rights.

# Assessing Drivers of Genetic Diversity on Coral Reefs

Camille Rumberger Sponsor: Rachael Bay, Ph.D. Evolution & Ecology

Coral reefs in the Anthropocene face a profound decline from a culmination of global and local threats. Genetic diversity can serve as the raw material for adaptation, buffering species from the effects of such stressors, yet large-scale surveys between and across species of coral are lacking. Therefore, it is essential to assess the drivers of genetic diversity and its consequences for recovery. Here we compile a global database of genetic diversity from microsatellites in species of Acropora, the largest coral genus. We use expected heterozygosity as a measure of diversity, and compare this to both species trait and spatial environmental data to uncover the drivers of this diversity. Preliminary analyses show that pH and species' upper depth limit are the variables most strongly associated with genetic diversity. Additionally, we find that the Caribbean Acropora palmata has unexpectedly high genetic diversity, the highest of any Acroporid species. These findings suggest that there is evidence for species-specific genetic diversity levels and that abiotic factors and anthropogenic induced stressors may influence the genetic diversity of the genus Acropora. Considering the importance of genetic diversity amongst populations, management strategies can utilize the information of allelic diversity to generate an assessment of large-scale ecological change.

# An Artistic Exploration of Women in Surrealism

# *Genevieve Ryan* Sponsor: Michael Subialka, Ph.D. Comparative Literature

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

# Fullerene Metal Coordination and Molecular Surgery

Josiah Sanchez

Sponsor: Alan Balch, Ph.D. Chemistry

Recent advances in synthetic chemistry have allowed for the possibility to perform molecular surgery and expand upon previous endohedral fullerene research. Molecular surgery enables us to perform C-C bond scission to create and enlarge orifices on the surface of a fullerene, as a precursor to small molecule insertion. Encapsulation after molecular surgery has been observed with smaller covalent compounds like water and formaldehyde. However, due to size, the isolation of platinum and palladium coordinated fullerenes are still being investigated. As per the findings of Murata, M. Murata, and K. Komatsu, palladium-fullerene coordination complexes have been isolated and identified. These findings suggest that coordinating another d<sup>10</sup> metal, such as platinum, would be a promising candidate for C<sub>60</sub> derivative, MMK9. MMK9 contains an activated carbon double bond surrounded by two carbonyl moieties, which facilitates metal coordination. It is our goal to synthetically execute these procedures, maximize purification and selectivity, isolate and crystallize these compounds, and characterize and host-guest interactions using X-ray crystallography as well as NMR, IR, and UV-Vis spectroscopy.

#### Social Skills and State Anxiety in Children

Previous research has shown a relation between social skills and anxiety in youth, such that higher anxiety symptoms are linked to poorer peer interactions. In this study, we examined children's self-reported state anxiety and social skills. Participants were 107 children ages 9-11 (Mean age = 9.90, SD = .59, 51.4% female) who completed the Social Skills Rating System (SSRS) and State-Trait Anxiety Inventory for Children (STAIC). State anxiety was reported 30 minutes after children underwent a modified Trier Social Stress Test (TSST-M), a wellvalidated social-evaluative stressor. The SSRS includes four subscales: cooperation, assertion, empathy, and self-control. State anxiety was negatively correlated with cooperation, r(97) = -.24, p = .017; assertion, r(96) = -.25, p = .012; empathy, r(97) = -.26, p = .008; and self-control, r(96) = -.21, p = .04. Our results indicate that children who reported higher state anxiety following a stressor also reported having poorer social skills. In the future directions of this work, we aim to understand how interventions, such as art therapy, may relieve state anxiety and improve social functioning in children. However, the directionality of this relationship is unknown.

# Controlled Error Checking CubeSat Operating System

*Mridul Sarkar* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The purpose of this project is the creation of a CubeSat Operating System, Space and Satellite Systems (SSS) Club has researched and developed novel pieces of flight ready hardware. Our mission's success relies on interfacing with these pieces of hardware as they work together in space without human intervention. In order to do this, the Computer Systems team of SSS has developed an autonomous Operating System (OS). Our OS is built on 'Modes', each being a different functionality of our satellite. A 'Mode' stays active or switches to another one based on the health of our CubeSat and its components. The health of our CubeSat is monitored by our watchdog and a dictionary of error codes which relays exactly what is wrong. This abstraction of logic has led us to a fully autonomous CubeSat due to the nature of our software development principles, OS architecture, and Concept of Operations. The Controlled Error Checking Operating System will be iterated upon and used for future CubeSat missions at UC Davis. Future work will include open source architecture for any CubeSat mission with little to no modification of internals.

#### *Mridul Sarkar* Sponsor: Bruno Nachtergaele, Ph.D. Mathematics

The purpose of this project is to develop a software library for Microsoft's Qsharp Language, an open source quantum computing language. I utilized Python and Qsharp to build the library and referenced the paper from Christoph D ?urr and Peter Høyer titled 'A quantum algorithm for finding the minimum'. I was fortunate enough to have help from Dr. Høyer, Dr. Sarah Kaiser, Dr. Chris Garnade, and Rolf Huisman throughout the development of this algorithm. I have built the algorithm and its test cases. I have rigorously proven the efficiency of the algorithm with reference to 'Tight bounds on quantum searching' and 'A fast quantum mechanical algo-rithm for database search'. I am in the process of testing the algorithm and verifying results. Currently computers can find the minimum of an unsorted database in computational complexity of O(N/2). The software library I have developed can find the minimum in O(log(N)). If we choose N to equal 1,000 a regular algorithm will find the minimum after 500 iterations whereas the quantum algorithm only takes 3 steps. This is a stark difference in computational efficiency and there is potential for disruptive industry application.

# Comparison of Machine Learning Models for Image Classification

*Mridul Sarkar* Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The purpose of this project is to teach UC Davis's first CubeSat when to collect pictures and IR sensor data. The Space and Satellite Systems (SSS) Club has developed a CubeSat that lays the foundation for low cost missions focused on Earth Science. This mission objective relies heavily on the problem of when to collect data and ensuring the quality of our data. This is accomplished through machine learning and information theory and processing by the Computer Systems Team of SSS. After dedicated research, we have compared and contrasted three methods for teaching our CubeSat: Linear Regression. Logistic Regression, and Support Vector Machine. Our results were verified with mathematical optimization. We are developing a novel data set, which is highly sought after in Machine Learning research, to further test our methods. Future work will include a novel method that will not only teach the machine, but allow it to actively learn at low cost to our power systems.

*Erin Scott* Sponsor: Elva Diaz, Ph.D. MED: Pharmacology

Modulation of AMPA-type receptor (AMPAR) trafficking at the postsynaptic membrane is a key component of synaptic plasticity. Previous results have indicated that the AMPAR auxiliary factor SynDIG4 has roles in clustering and maintaining pools of extrasynaptic AMPARs necessary for synapse development and plasticity. In this study, we aim to characterize SynDIG4 trafficking route and identify the mechanism by which it interacts with AMPARs. We hypothesize that SynDIG4 first transiently traffics to the plasma membrane to capture GluA1. We predict the GluA1-SynDIG4 complex then becomes internalized where it concentrates as a pool of extrasynaptic receptors. In this study, we first blocked endocytosis chemically using the endocytosis inhibitor, dynasore. We then identified a putative endocytic motif, which we predicted as necessary for its internalization. Using site-directed mutagenesis, we designed multiple SynDIG4 mutants to disrupt this motif's function. Preliminary results indicate SynDIG4 accumulation at the cell surface upon inhibition of endocytosis, suggesting the protein is trafficked to the plasma membrane. We plan to extend the study by co-expressing GluA1 and assess effects on localization of the subunit. These studies provide insight into the localization and trafficking of SynDIG4, which will further contribute to the understanding of its role in AMPAR related synaptic plasticity.

#### Parenting Effects on Language Development in Mexican-American and Chinese-American Dual Language Learners

*Nina Sendra Funato* Sponsor: Yuuko Tonkovich, Ed.D. Education

Past research has found mixed results on the relation between parenting styles and the development of young children's language skills. More research is needed with dual language learners (DLLs) to promote bilingual development, especially to maintain their heritage language skills. This project was anchored to examine parenting styles and practices in families with DLLs and to investigate the association between parenting styles (authoritarian and authoritative) and parenting practices (amount of parent-child activities) and their collective effects on Mexican American (MA) children and Chinese American (CA) DLLs' oral comprehension and vocabulary retention of heritage language, controlling for confounders of parental language dominance and parental educational levels. Data were collected from a total of 55 MA and 64 CA DLLs enrolled in Head Start programs and their first-generation parents. Parenting Styles and Dimensions Questionnaire (PSDQ) and demographic survey were completed by parents to investigate parenting styles and parenting practices. MA and CA DLLs were assessed on their heritage language oral proficiency. Preliminary results suggest that parenting styles and practices were similar for MA and CA parents and parenting practices were more associated with children's heritage language development than parenting styles. Implications for families will be discussed.

### Characterizing Radiation Damage in Materials with Molecular Dynamics

*Chad Serrao* Sponsor: Jeremy Mason, Ph.D. Materials Science&engineering

Radiation is known to cause damage to the microstructure of material systems. High-energy particles can displace atoms from their lattice sites in crystalline materials, introducing high concentrations of point defects that change the mechanical properties of the material (e.g. a decrease in both strength and ductility). While molecular dynamics simulations have previously been used to simulate this process, simulations of displacement cascades are computationally expensive enough to generally limit the radiation dose to values well below those relevant to experiments. Our research instead makes use of a displacement-relaxation algorithm that is conjectured to result in the same configurations, but minimizes the computational cost, allowing simulations of larger material systems with higher radiation doses. Improving our understanding of radiation damage potentially allows for the design of materials that better resist radiation damage, with applications in fission and fusion reactors, nuclear waste storage, and radiation protection systems for future space missions.

# Exploring the Relation between Contextual Attention and Theory of Mind in Children

*Ujashi Shah* Sponsor: Lindsay Bowman, Ph.D. Psychology

Theory of Mind (ToM) describes the understanding that internal mental states, such as desires, beliefs and thoughts, guide external behavior in the real world. ToM is foundational to functioning in the social world, including teaching, moral judgements and cooperation. This understanding develops dramatically from ages 3- to 8-years, but more research is needed to uncover all of the contributing factors (e.g., language development) that support the transition to a mature understanding of others' mental states. This project will examine a theoretically important but underexplored contributor to children's ToM: the ability to attend to contextual information in a scene, and to use that information to inform judgements about a character's mental state. Prior research has shown reliable individual differences in children's context sensitivity that are independent of other non-social skills (e.g., executive function). The present study examines children's attention to contextual information in both social and non-social scenes, and how individual differences in these skills relate to ToM in children ages 4- to 8-years-old. The research study is ongoing, data collection will be done through an online platform, and results and analyses will be completed by spring of 2021.

#### Crystal Structure Characterization and Electronic Structure of a p-type Zintl Phase Thermoelectric Material: Yb<sub>3</sub>AlSb<sub>3</sub>

# **Rongqing Shang** Sponsor: Susan Kauzlarich, Ph.D. Chemistry

Thermoelectric materials are capable of producing a voltage under a temperature gradient. Material efficiency depends on the figure of merit zT ( zT =  $a^{2}T/\rho\kappa)$  , where a is the Seebeck coefficient,  $\rho$  is the electrical resistivity,  $\kappa$  is the sum of the lattice and electrical thermal conductivity, and T is the absolute temperature. These parameters are strongly coupled, and an ideal material is required to have a combination of both efficient electron transport and strong phonon scattering. Zintl phases are a structural category of materials that generally feature complex crystal structures due to the large range of bonding that can be accommodated. Related phases to Yb<sub>3</sub>AlSb<sub>3</sub> have shown decent zTs that have been achieved by doping. For example, the Na-doped Ca<sub>3</sub>AlSb<sub>3</sub> yields a maximum zT of 0.8 at 1050 K. A similar structure with a more metallic element on the cation site, Yb<sub>3</sub>AlSb<sub>3</sub>, has been obtained by metal flux methods. Herein, the synthetic conditions, the crystal structure determined from single-crystal X-ray diffraction data, and electronic structure calculations are reported. Further research will focus on doping the Yb with other elements for property optimization.

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

*Mukul Sharda* Sponsor: Ben Reeb, Ph.D. Psychology

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

# Relationship Between Socioeconomic Status and Pediatric Diagnoses of Anxiety in Girls with Fragile X Syndrome

Roxanna Sharifi

Sponsor: Paul Hagerman, M.D.,Ph.D. MED: Biochem & Molecular Med

Fragile X Syndrome (FXS) is caused by an expanded CGG repeat in the 5' untranslated region of FMR1, an X-linked gene. It is known as the most common heritable cause of intellectual disability and autism and is comorbid with anxiety. It has been previously demonstrated that individuals with FXS from lower socioeconomic statuses (SES) exhibit impaired social and cognitive function. The objective of this project is to determine if a positive correlation exists between lower SES and anxiety disorders in girls with FXS. Child behavioral data were analyzed between control (n=42) and FXS (n=55) participants, aged 6-16, and their respective SESs. ECG data collected during the NIRS conversation task, where participants were prompted to maintain eye contact during a conversation, will also be analyzed as a measure of anxiety and arousal. T-test results for the behavioral data suggest that girls from a lower SES in the control group, but not in the FXS group, show higher levels of anxiety-related behavior. These preliminary findings support the emotional internalization of girls with FXS and emphasize the importance of broader SES representation in future studies to better understand the socioemotional and behavioral impact of FXS in the context of environmental influence on anxiety.

# Borderline Personality Disorder: A Stigmatized and Misunderstood Mental Disorder

Anshika Sharma Sponsor: Daniel Melzer, Ph.D. University Writing Program

Borderline Personality Disorder (BPD) has been defined by the American Psychological Association (APA) as "a personality disorder characterized by a long-standing pattern of instability in mood, interpersonal relationships, and self-image that is severe enough to cause extreme distress or interfere with social and occupational functioning." Research shows that BPD is among the most stigmatized mental disorders and is often associated with negative symptoms or behaviors. This research project discusses BPD, a disorder that is stigmatized by both society and mental health professionals. The research method I primarily used for this project was reviewing several peerreviewed journals and literature on the topic. The stigmatization of BPD throughout the years has made it difficult for patients to get access to psychological and psychiatric treatment. Furthermore, such individuals face misdiagnosis, which delays the treatment process further. Training programs and interventions for nurses and practitioners have assisted in reduced stereotyping and better treatment for patients. Mental health advocacy and increased research has reduced the stigma associated with BPD by a significant amount and has cleared differences between similar disorders. Additionally, advocacy has allowed advocates and professionals to convey accurate and necessary information about BPD to patients' families, as well as the general public.

# Blunt Aortic Injury: A Review of Techniques and Outcomes

### *Kritika Sharma* Sponsor: Steven Maximus, M.D. MED: Surgery

Blunt aortic injury is the second leading cause of death in all blunt traumas. These injuries most commonly occur because of motor vehicle crashes, in which rapid deceleration causes a tear to the aorta, the largest blood vessel in the body. Most patients don't survive long enough to reach the hospital. For those that do, there are different options to treat this injury. Traditionally, they've been repaired with open surgery. Recently, surgeons have begun to use a minimally invasive technique called Thoracic Endovascular Aortic Repair, also known as TEVAR. This specialized technique allows surgeons to perform the entire operation through two small incisions in the groin. This is significantly less invasive than opening up the chest as is necessary for other procedures. This study will perform a retrospective chart review of patients who have been diagnosed with a blunt aortic injury. Our primary endpoints are mortality and neurologic deficits. Led by UC Irvine, this study aims to evaluate how the TEVAR technique, as opposed to other operations, is performed at the five different UC Health System institutes. It also aims to assess the long-term outcomes of patients who have had both open aortic repair and TEVAR performed due to blunt aortic injury.

# The Role of GAS6/AXL Expression in Malignant Melanoma and GI Cancers

*Kritika Sharma* Sponsor: Amanda Kirane, M.D. MED: Surgery

The interaction of two proteins, Axl and Gas6, has been implicated in lung, breast, and pancreatic cancers. The Axl pathway plays a significant role in resistance to immunotherapy, the treatment of disease via immune system stimulation. Gas6 has been identified as the only ligand that binds the extracellular domain of Axl. Gas6 and Axl levels have been shown to correlate strongly with the stage of cancer, overall survival, and recurrence patterns. However, this pathway has not yet been examined as a potential biomarker for response to immunotherapy and an early indicator of melanoma progression. The goal of this study is to assess Axl expression as a clinical correlate of response to therapy in malignant melanoma as well as evaluate Gas6 as a marker of disease state and response to therapy in multiple organ tumors, including gastrointestinal (GI) and liver tumors. This is a prospective and retrospective study in which we'll collect blood and tumor tissue samples from new, qualifying patients and review samples from previously banked patients. These samples will be analyzed for AxI and Gas6 levels. We plan to use this study as a basis for future therapeutic models, particularly as a potential biomarker of response to immunotherapies.

Xiaotian Shen Sponsor: Bo Lonnerdal, Ph.D. Nutrition

Osteopontin (OPN) is a pleiotropic protein mediating differentiation of adipose tissue, appearing at high concentrations in human milk. Formula-fed infants exhibit a significantly higher BMI in childhood than breast-fed infants. Therefore, we hypothesized that oral intake of milk OPN during infancy may regulate development of obesity. An OPN knockout (KO) mouse model was used since OPN is abundant in mouse milk also. After male wild-type (WT) mouse pups were nursed by WT or OPN knock-out (KO) dams from postnatal day 1 to 21, pups were fed regular (10% kcal from fat, control) or high fat (60% kcal from fat, HF) diets for 10 weeks. No differences were found in body weights or composition in WT and KO control groups, and the KO HF group weighed significantly more than the WT HF group (~8%) and had more fat than the WT HF group (~8%) by wk 10. KO HF mice were less sensitive to insulin and glucose stimulation than WT HF mice at wk 9. No differences were observed in white adipose tissue morphology between WT HF and KO HF mice. These findings suggest that oral intake of milk OPN may lessen the risk for development of obesity later in life.

# Social Recognition in Oxytocin Receptor Knockout Prairie Voles (*Microtus ochrogaster*)

Rana Sherkat Sponsor: Karen Bales, Ph.D. Psychology

The ability to recall the learned idiosyncratic identity of a conspecific is referred to as "social recognition". Social recognition is an integral component of prairie vole social behavior for protection, inbreeding avoidance, monogamous mate selection, and comfort. Prairie voles display aggression or affiliation based on their lack or presence of recognition, respectively, mediated through oxytocin receptors (OXTR). We hypothesized that a complete knockout of OXTR would result in a loss of social recognition in prairie voles. To assess this hypothesis, we used a sample of prairie voles (n = 80) recruited in a 2-by-2 design with conditions of gonadal sex and genotype (i.e. WT and OXTR Knockout). Social recognition was assessed using a standardized "habituation / dishabituation" paradigm, in which animals were first habituated to a novel social stimulus across four sequential, 5-minute exposures (trials 1-4) and then observed for a fifth trial for a second, novel social stimulus (i.e., "dishabituation"). Wild-type animals of both gonadal sexes were expected to follow a behavioral pattern consistent with decreasing interest in the first stimulus across trials 1-4 with a subsequent increase in interest in trial 5. OXTR knockout animals of both gonadal sexes were expected to show a contrasting, divergent pattern.

*Traci Shiu* Sponsor: Priya Shah, Ph.D. Chemical Engineering

Zika virus (ZIKV) emerged as a public health threat in 2015, warranting worldwide attention due to its association with birth defects. ZIKV infection during pregnancy is linked with birth defects in newborns, the most severe being microcephaly, in which brain and head size are significantly reduced, resulting in profound developmental disability. The molecular mechanisms bv which ZIKV infection contribute to abnormal neurodevelopment are not understood. Viral-host proteomics have identified an interaction between the ZIKV protein NS4A and the human protein ANKLE2. This interaction is significant because ANKLE2 is associated with genetic microcephaly in humans. Previous studies showed that ZIKV NS4A induced microcephaly phenotypes in fruit flies in an ANKLE2-dependent manner. In this study, we will build a vertebrate model, using zebrafish, to further investigate how NS4A induces microcephaly through interaction with ANKLE2. Using CRISPR mutagenesis we will generate ankle2 using Tol2-transgenesis we will express ZIKV NS4A. We hypothesize that both conditions will result in similar microcephaly phenotypes that can be subsequently rescued by human ANKLE2.

#### Learning to Look in a Pandemic: An Exploration on the Impact of Masks on Infant Facial Recognition

Priyanka Shreedar Sponsor: Lisa Oakes, Ph.D. Psychology

From birth, infants preferentially look to the faces in their environment. Across the first year of life, infants prioritize different regions of the face (e.g., the eyes or mouth) as various visual cues become more or less relevant. For example, as infants learn language, they may prioritize their attention to the mouth of a speaker (Lewkowicz & Hansen-Tift, 2012). As a result of the COVID-19 pandemic, face masks have become a part of daily life for many Americans, raising the question: will face masks affect our ability to recognize one another? Studies investigating this question have found that adults are impaired at both learning and recognizing faces with masks (Carragher & Hancock, 2020). Given the importance of faces for infants' learning, we tested whether infants would show differential learning and recognition patterns to masked and unmasked faces. Additionally, we asked parents to report on their infant's experience seeing people wear face masks. To date, we have tested approximately 50 infants aged 4- to 12-months online and are currently analyzing this data to present in the Spring. This work will contribute to our understanding of how various aspects of facial input are related to infants' learning across the first year of life.

*Taylor Silva* Sponsor: Lee Pu, M.D.,Ph.D. MED: Surgery

Injection of hyaluronic acid soft tissue fillers is a popular nonsurgical aesthetic procedure. While it is generally regarded to be safe, severe complications do exist, most notably skin ischemia/necrosis and blindness, which occur secondary to iatrogenic occlusion of vessels. These complications necessitate prompt injection of hyaluronidase (an enzymatic reversal agent that breaks down hyaluronic acid fillers). The authors sought to determine the immediate availability of hyaluronidase among Californian ERs, as well as the institutional and geographical predictors of hyaluronidase availability. The authors conducted a scripted telephone survey inquiring about hyaluronidase availability for all Californian ERs. Using a  $\chi^2$  test, the proportions of hyaluronidase availability were compared using different parameters. A Mann-Whitney U test was used to compare median bed counts between hospitals that had hyaluronidase available and those that did not. The present study included 330 Californian ERs and achieved an 89.7% response rate (n=296). Overall, 45.6% of ERs were found to not have immediate access to hyaluronidase. Ultimately, hyaluronidase availability in ERs is unreliable across the state of California, posing a risk to patient safety as ERs are often expected to function as a safety net for hyaluronic acid filler ischemic complications.

# Examining Speech Toward Alexa versus humans: A comparison of adults and children

Sarah Simpson Sponsor: Georgia Zellou, Ph.D. Linguistics

Voice assistants such as Alexa and Siri are now commonly used in the home and everyday life, yet our scientific understanding of these interactions is still in its infancy. This study tests how people of different ages (college-age adults and children, ages 7-12) talk to an Alexa device versus a human. The interactions, conducted over Zoom due to social distancing restrictions, were controlled so that participants said the same sentences to the Alexa and human interlocutors. Subjects see a list of 24 words and, on each trial, the experimenter or device asks what the next word on the list is. The subject replies with the corresponding word on their list ("The word is pig"). Then, the experimenter or device says the word back and asks the subject to repeat the sentence; on 4/24 of trials, the interlocutor mishears the pronunciation, saying a second word with a consonant error ("I heard pig or pick"). Videos are annotated in ELAN and manually checked. We predict that adults and children will show differences in the way they adjust their speech for a human versus Alexa interlocutor. Broadly, this work can reveal the impact of voice assistants on language behavior across the lifespan.

# Tzu-Ni Sin

Sponsor: Glenn Yiu, M.D.,Ph.D. MED: Eye Center

Our lab has been utilizing CRISPR-based genome editing technology to develop potential gene therapy for retinal disorders. We previously identified single guide RNAs (gRNAs) targeting exon 1 of the vascular endothelial growth factor-a (VEGFA) gene in mice, rhesus macaques, and humans, and demonstrated efficient VEGF suppression in mouse retina. Here, we evaluate the efficacy of this CRISPR system to edit VEGFA gene in the rhesus and human genome using a cell-free system. In silico analyses indicated on-target activity of V1 and V2 target sequences were 60.5 and 49.5 for rhesus, and 60.0 and 54.0 for human VEGFa, respectively, and the off-target scores were 43.5 and 45.5 for rhesus and 43.0 and 45.0 for human VEGFa. The RNPs were synthesized by incubating each gRNA (V1 and V2) with S.Pyogenes Cas9 (SpCas9) protein, then the target VEGFa PCR amplicons were incubated with V1, V2, or V1+V2 RNPs. The result showed that the genome editing efficiencies with V1 gRNAs, V2 gRNAs, and V1+V2 gRNAs were 46.39%, 20.95%, and 44.60% for the rhesus VEGFA and 84.72%, 37.10%, and 68.54% for the human VEGFA, respectively. This study demonstrated effective CRISPR-based genomic ablation of the VEGFA gene using SpCas9 RNPs in both rhesus and human aenome.

# Language, notation & meaning: Children's articulation of their emergent fraction ideas

*Reshmika Singh* Sponsor: Rebecca Ambrose, Ph.D. Education

This research will focus on children's use of academic language when discussing fractions. It is also focused on their mathematical thinking related to fractions. Research indicates that if fractions are to be learnt from a deeper understanding, students need to understand the concept of whole numbers. An understanding of fractions is important to lay a foundation for students to understand more advanced mathematical concepts. In order to conduct this research, we will be analyzing the mathematical language used by 3 to 10 third- fifth graders (ages 10 to 12) in interview contexts. The aim is to see how children use language to express their interpretations of fractions. The hypothesis is that children tend to be imprecise when talking about fractions which can lead to misconceptions. This analysis is intended to provide teachers with examples to consider so they can do a better job of supporting students in learning the language and concepts of fractions.

### Perinatal Exposure to Secondhand Smoke on Susceptibility to Viral Infection and Bacterial Challenge.

*Neha Singh* Sponsor: Kent Pinkerton, Ph.D. MED: Pediatrics

Secondhand smoke (SHS), also referred to as passive smoke exposure, is a common malady in our society. In early life, it has been estimated more than 40% of children are exposed to SHS, typically in the home. However, the impact of early life exposure to SHS on the immune response is unclear. Thus far, initial findings indicate that neonatal mice exposed to SHS with viral and subsequent bacterial challenge are associated with a significantly higher incidence of mortality and a marked increase hyaline membrane formation. I performed in the immunohistochemistry to evaluate the degree of inflammation and abundance of CD4 helper, and CD8 cytotoxic T-cells in the lungs of neonatal mice under 3 different conditions: filtered air (FA) control, FA+virus+bacteria, and SHS+virus+bacteria. Lung tissues were evaluated by measuring the extent and severity of the following histological sites: pleura, alveolar, airways, and blood vasculature. The findings demonstrate CD4 and CD8 cells are more abundant in mice exposed to SHS+virus+bacteria compared to FA+virus+bacteria. Both treatment groups are different from FA control groups to suggest a significant role of CD4 and CD8 in the perinatal inflammatory response to SHS and viral infection.

# The Spread of Disinformation by Crisis Pregnancy Centers

*Alisha Singh* Sponsor: Emily Merchant, Ph.D. Science & Technology Studies

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

### Maternal Condition and Offspring Sex Ratio in Centrocercus urophasianus

Katie Smith Sponsor: Gail Patricelli, Ph.D. Evolution & Ecology

Many species will invest differentially in male and female offspring by altering either the number of each sex in their broods or the distribution of resources and parental care. The Trivers-Willard hypothesis states that females in lekking polygynous systems will allocate parental investment according to their own characteristics and changes in the environment. Though this physiological mechanism has been studied across taxa, it has yet to be examined in Greater sage-grouse (Centrocercus urophasianus), a species of conservation concern that is used as a model organism for research on lekking systems. I will measure female stress endocrinology, morphometrics, age, and temporal egg laying strategies in order to determine the predictive power that maternal condition and experience may have on male biases in offspring sex ratios. Quantifying this relationship will elucidate the underlying physiology of brood demographics, and through this understanding, the broader implications that anthropogenic stressors may pose on population success.

# California Education Funding in Context: How Supplemental and Concentration Grant Funding Varies by School District Demographics

Samuel Snelson Sponsor: Jacob Hibel, Ph.D. Sociology

Past research has found mixed results on the support California's 2013 educational funding reform has provided. The only consensus is more attention is needed to foster and practice educational equity. However, research is limited on how districts' demographic context influences their spending priorities for disadvantaged students - namely, districts' use of supplemental and concentration grants which are provided to districts with high percentages of foster youth, English learning, and/or free or reduced meal eligible students. This study uses California school districts' Local Control and Accountability Plans (LCAPs) and the American Community Survey on Education (ACS-ED) between 2013-14 and 2018-19. Using computational text-analysis and quantitative methods, this study investigates how supplemental and concentration grants vary by districts' (1) total budgets, (2a) demographic composition - including race, socioeconomic status and district enrollment, and (2b) contextual factors - including residential property value/type and area classification. A better empirical understanding of the relationship between districts' supplemental and concentration funding and their surrounding demographic environment may equip California officials and administrators to better evaluate the efficacy of their endeavors for educational equity. Finally, this study discusses the methodological utility of LCAPs for the oversight of and research on education funding.

*Talia Soalt* Sponsor: Justine Smith, Ph.D. Wildlife & Fisheries Biology

The frequency, size, and severity of wildfires in California are increasing, likely due to a recent history of fire suppression and climate change. A changing fire regime has the potential to disrupt wildlife behavior, including activity and habitat use. This may present particular challenges for wildlife that are also subject to pressures from humans in urban systems. One such system, the Santa Monica Mountains, is a chaparral-dominated, montane ecoregion adjacent to Los Angeles, California, the western third of which burned in the mixed severity Springs Fire of 2013. In addition to this recent fire, wildlife in this system contend with habitat fragmentation and urbanization. Using data collected from remote camera traps in 2014, I investigated wildlife activity relative to fire and human development by applying generalized linear models to estimate detection rates. I focused my analysis on mule deer (Odocoileus hemionus) because little is known about the impact of fire and urbanization on this species. Additionally, I included coyotes (Canis latrans) as a focal species, as they are a main predator in this system. As wildfires and population densities increase in California, my findings will offer insights into how wildlife navigate these complex challenges.

# A Comparison of Negative Affect and Vocalizations Among Infants Developing ASD and Risk for ADHD

*Makayla Soller* Sponsor: Meghan Miller, Ph.D. MED: Psychiatry & Behav Sci

Although symptom profiles are distinct, autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) frequently co-occur and exhibit some overlapping symptoms that likely originate from shared developmental pathways. Better understanding early manifestations of ASD and ADHD symptoms may result in earlier identification and intervention. This study sought to determine whether there are differences in frequencies of vocalizations and negative affect among infants developing ASD, ADHD Concerns, or neither. Infants at familial risk for ASD (n=85), familial risk for ADHD (n=37), or low-risk for both (n=35) were recruited at 12 or 18 months of age and followed prospectively at 12, 18, 24, and 36 months. At 36 months infants were classified into one of three outcome categories: ASD (n=24), ADHD Concerns (n=19), or Non-ASD/Non-ADHD Comparison (n=114). At each visit, infants were video recorded during a standardized developmental assessment from which five-minute segments were coded for frequencies of vocalizations and negative affect. Results indicated more frequent negative affect, across ages, among infants with ADHD Concerns outcomes and more frequent vocalizations among those with both ASD and ADHD Concerns outcomes. Early patterns of negative affect and vocalizations may help identify later ASD and ADHD Concerns which could help lead to earlier identification and intervention.
#### Narrative Medicine: Accessibility and Potential Tool for Pre-Health Education

#### *Felicia Song* Sponsor: Amy Clarke, Ph.D. University Writing Program

Narrative Medicine (NM) argues for an approach to healthcare based in the ethical and humanitarian function of stories and storytelling to alleviate conflicts arising from a historically instilled ethic of detached objectivity in medicine and more. It is a dedication to improve clinical care that draws from the study of the liberal arts, a form of interdisciplinary approach that seeks to enhance skills of listening, empathy, critical analysis, cultural humility, affirm humanistic relationships between patients and their providers, and finally, answer the question of "What might medicine be for?" Such study has salient potential to reimagine healthcare to be more ethical, holistic, as well as provide adequate frameworks for professional/aspiring professionals to reflect meaningfully on their work. My study analyzes the accessibility and anecdotally transformative effects of NMbased education by reviewing NM's replicable structure and methodology and conducting unstructured interviews with affiliated medical students/healthcare professionals who have studied NM either directly or indirectly through Columbia's NM program, workshops, and research. I will also examine and advocate for an alternative or informal education that is accessible and critical at an undergraduate level through interviews of pre-health students that fortify their clinical experiences through NM or pillars within NM study.

#### Identifying Trends in Research and Technology using Natural Language Processing

#### Patrick Soong Sponsor: Setareh Rafatirad, Ph.D. Engr Computer Science

This paper discusses the idea of using natural language processing to identify trends in technological research and development by extracting key terms and their semantic meanings from publication titles and text corpus. We processed the texts by training a Word2Vec model to extract key terms, or n-grams, from a text corpus composed of Google Scholar documents. The key terms are then correlated with temporal data and a label obtained from the Gartner's Hype Cycle for "Emerging Technologies" in order to identify trends between a technology's popularity and research and development progress. We select a classification model to classify the document's topic in a technological domain, and then use a time series model to predict the trend of a specific document within the technological domain. We present experimental results exploring the feasibility of developing a recommendation system to help quide researchers in selecting new technologies and domains for their research purposes.

# The Disproportionate Effects of the COVID-19 Pandemic on the Latinx Community's Health and Finances

#### Jessica Soto Sponsor: Marcella Gonsalves, Ed.D. MED: Public Health Sciences

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

# Ensuring the Safety of Deep Neural Network-Based Artificial Intelligence Applications

*Matthew Sotoudeh* Sponsor: Aditya Thakur, Ph.D. Engr Computer Science

Deep neural networks solve artificial intelligence problems by mimicking the neural wiring architecture of our brains. They have made new applications, such as self-driving cars, possible. However, they are inherently difficult for people --- even their designers --- to understand and predict. This raises many concerns about the safety and fairness of such applications. Our work extends the tools of program analysis to work on such artificial intelligence systems. Using these tools, we can predict exactly how an artificial intelligence system will react to an infinite number of possible situations. This allows us to check that such systems will always behave safely, even in rare or unseen scenarios. If the possibility of unsafe behavior is identified, our approach can also be used to explain why the network is behaving in that way. Finally, we also provide new tools to precisely target and correct such unsafe behavior. In this way, our work helps ensure that these powerful new artificial intelligence systems are also safe.

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

*Owen Sowerwine* Sponsor: Kate Scow, Ph.D. Land Air & Water Resources

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

#### Investigating the Neural Correlates that Mediate the Effect of Delay on Memory Quality

James Spargo Sponsor: Charan Ranganath, Ph.D. Psychology

Why do we remember some things and not others from the same event? Research has found that over time, central details (CD) of a narrative are better retained than peripheral details (PD), though it is unclear which regions of the brain are responsible for this memory retention. Our study attempts to investigate how memory for events changes over time and identify the brain regions associated with retention. Participants in this study watched two short-movies while undergoing an fMRI scan. One of the movies was recalled immediately and the other was recalled after a 2-day delay. Then, the audio recordings of the recalled movies were scored for CD and PD. Using the scored recall, we calculated the correlation between brain activity during movie viewing and the quality of subsequent retrieval. Our behavioral findings were congruent with prior research - participants remembered fewer details after a 2-day delay compared to the immediate delay with CD better preserved over the delay than PD. Interestingly, we found hippocampal activity at the event boundaries during encoding correlated with memory for CD at the 2-day delay, but not the initial recall. This data suggests that hippocampal activity is important for retention of the gist of events.

Sanghavi Srinivasan Sponsor: Eleanor Schwarz, M.D. MED: Int Med - Genl Medicine

Pregnancy-even when desired-is a risk to a woman's health. Emergency contraception (EC) pills taken within 5 days of sex can prevent pregnancy. Levonorgestrel (Plan B<sup>™</sup>) EC pills are available throughout the United States without a prescription, but the more effective ulipristal (ella™) EC pills require a prescription. When undesired pregnancy occurs, abortion pills (mifepristone and misoprostol) can be safely used up to 11 weeks gestation. We assessed Californian family planning clinics' ability to provide EC and abortion pills to women seeking assistance by phone by performing a cross-sectional "secret shopper" survey of a 20% random sample, stratified by county, of clinics participating in California's Family Planning Access Care and Treatment program. Of the 208 clinics we contacted, 71% offered Plan B, 29% provided ella, and 12% indicated they would be able to provide abortion pills if needed. A considerable number of phone staff were not sure how to respond to women calling with a time-sensitive need for family planning services; specifically, 17%, 48%, and 34% did not know if their clinic offered Plan B, Ella, and abortion pills, respectively. Efforts remain needed to increase access to EC and abortion pills for Californian families.

# Hey Bro, Do You Even Take the Lift?: Semantic and Phonological Factors Affecting Cross-Dialect Intelligibility of Speech in Noise

*Riley Stray* Sponsor: Georgia Zellou, Ph.D. Linguistics

Dialects, regional varieties of a language, differ both in how words are pronounced and which words are used in which situations; for example, American speakers often use the word "rubber" to refer to a material while British speakers may say it referring to an eraser. We utilized "false friends," words across dialects/languages with the same form but different meaning, to investigate how semantic factors interact with phonology in lexical access. We created semantically-predictable sentences that cue American or British meanings, generated our sentences spoken by American and British synthetic voices, and presented them to study participants who listened and wrote the last word they heard. Responses were coded for accuracy and our results, modeled with a mixed effects logistic regression, showed greater intelligibility of the British synthetic voice (p<0.001), greater intelligibility for the sentences cueing American meanings (p<0.001), and higher accuracy for sentences where the spoken dialect and lexical dialect were aligned (p<0.05). Overall, results suggest both phonological and semantic properties of words contribute to speech intelligibility across dialects, agreeing with previous studies that a listener's past experience with an individual word can affect how that item is parsed when strongly associated with a certain dialect.

#### Measuring the Effectiveness of Undergraduate Teaching Assistants to Analyze Differences in Instruction in Chemistry Laboratories

#### Muhammad Sulman

Sponsor: Ozcan Gulacar, Ph.D. Chemistry

Beginning in Fall 2017, the Chemistry Department at UC Davis established a pilot program through which undergraduate teaching assistants, formally known as Emerging Scholars (ES), are introduced into laboratory settings to work alongside graduate teaching assistants (TA). To study the differences in student interactions with the TAs and the ESs, every TA and ES was asked to audio record their conversations during two lab sessions. After the audio data were collected, they were first transcribed, and student interactions with the lab instructors were coded using Laboratory Observation Protocol for Undergraduate STEM (LOPUS). The findings of this study will reveal whether students are more comfortable approaching TAs or ESs, and how the teaching styles may vary between the two lab instructors. Student inquiries and TA's or ES's responses will be carefully examined to better understand the instructional styles in the labs. These observations and analyses will reveal the efficacy of the Emerging Scholars program and provide insight on methods to enhance student learning experiences.

#### **Expanding Biodesign Education and Outreach**

*Kiyomi Sun* Sponsor: John Furlow, Ph.D. Neuro Physio & Behavior

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

#### Parenting Effects on Language Development in Mexican-American and Chinese-American Dual Language Learners

Qianya Sun

Sponsor: Yuuko Tonkovich, Ph.D. Education

Past research has found mixed results on the relation between parenting styles and the development of young children's language skills. More research is needed with dual language learners (DLLs) to promote bilingual development, especially to maintain their heritage language skills. This project was anchored to examine parenting styles and practices in families with DLLs and to investigate the association between parenting styles (authoritarian and authoritative) and parenting practices (amount of parent-child activities) and their collective effects on Mexican American (MA) children and Chinese American (CA) DLLs' oral comprehension and vocabulary retention of heritage language, controlling for confounders of parental language dominance and parental educational levels. Data were collected from a total of 55 MA and 64 CA DLLs enrolled in Head Start programs and their first-generation parents. Parenting Styles and Dimensions Questionnaire (PSDQ) and demographic survey were completed by parents to investigate parenting styles and parenting practices. MA and CA DLLs were assessed on their heritage language oral proficiency. Preliminary results suggest that parenting styles and practices were similar for MA and CA parents and parenting practices were more associated with children's heritage language development than parenting styles. Implications for families will be discussed.

# Chronic Failures in California's Wildfire Mobile Alert System

Brendan Sweeney Sponsor: Mark Verbitsky, Ph.D. Political Science

California faces increasingly frequent, dangerous wildfires that encroach on densely populated areas. To save lives, local government increasingly target mobile devices to issue evacuation orders and warnings. Two of California's five deadliest wildfires have occurred in the past five years despite mobile alert innovations; both fires were marked by massive failures to effectively alert residents using mobile devices. I review disaster communications literature to identify the key components of an effective mobile alert. Effective systems rely on a diverse set of notification tools, follow a clear set of content standards, and target a sufficiently broad population. These elements increase the level of public risk perception, spurring protective action from residents. I consider recent wildfires in three Northern California counties, Sonoma, Butte, and Yolo, in the context of effective mobile alerts. They share an identical pattern of failures. Those failures include overreliance on opt-in alert tools, poor use of the national Wireless Emergency Alert system, and a lack of non-English language emergency alerts. Sonoma, Butte, and Yolo counties have made or are making progress in addressing these failures, but only after catastrophes. I recommend steps California might take to preempt this pattern of reform after predictable, deadly failures.

# Inughuit, Polar Explorers, and Glass Beads in late 19<sup>th</sup> and early 20<sup>th</sup> Century Northwestern Greenland

*Michael Sze* Sponsor: Christyann Darwent, Ph.D. Anthropology

The Inglefield Land Archaeology Project undertook archaeological excavations at the site of lita, in northwestern Greenland in 2006, 2012, and 2016. Occupation of lita spans the past 1000 years, but the focus here is on the contact period. Among the historical items recovered from this Inughuit site were numerous glass beads. These are likely associated with Donald MacMillan's Crocker Land Expedition, which resided at lita between 1913 and 1917. However, they could also date to earlier arctic explorers, including the North Pole expeditions of Robert Peary and Matthew Hensen. This study aims to provide a more detailed analysis of these beads by comparing the stylistic type patterns found within lita to bead assemblages found elsewhere in the eastern North American Arctic, with the goal of tracing their provenance. The presence of glass beads at lita is particularly interesting because unlike most lnuit groups who interacted with European and American traders, Inughuit never incorporated trade beads into their clothing.

### Intraoperative Fluorescence Lifetime Imaging (FLIm) for Real-Time Label-Free Delineation of Oropharyngeal Carcinoma of Unknown Primary Origin

Athena Tam Sponsor: Laura Marcu, Ph.D. Biomedical Engineering

Oropharyngeal carcinoma of unknown primary origin is a rare head and neck cancer afflicting approximately 3,000 patients annually. These tumors are challenging to detect and cannot be identified after exhaustive clinical, radiographic, and surgical evaluation. Successful patient outcomes depend on the complete removal of these tumors, however low detection rates have motivated the search for novel approaches to facilitate the detection and excision of these elusive tumors. Herein, we investigate the use of multi-spectral Fluorescence Lifetime Imaging instrument integrated into the da Vinci SP transoral robotic surgical platform (TORS) to delineate these tumor cohorts. Intraoperative FLIm point-spectroscopic measurements were acquired in vivo bilaterally on palatine tonsil and base of tongue tissues on N=8 patients at the UCDMC presenting with metastatic SCC to the head and neck with unknown primary site. Machine learning was used to assign spectroscopic point measurements to a healthy vs. cancer prediction. Bilateral tonsillectomy and base of tongue excision procedures were then performed and used for histopathological validation. Carcinoma was successfully located and excised in 4 patients (50%). Collectively, FLIm demonstrated a mean sensitivity of 90  $\pm$ 11.1% and specificity of 92  $\pm$ 7.8%, indicating excellent discrimination and demonstrating promising preliminary results for aiding intraoperative surgical decision-making.

## Theoretical and Practical Analysis of Structural Mechanics for STEM Education

Yash Taneja Sponsor: Mohamed Hafez, Ph.D. Mechanical & Aerospace Engr

The physics and mathematics behind engineering problems are often taught in the classroom without supplemental hands-on, physical learning. To help fill this gap, the physics, analytical solution, numerical solution, and experimental correlation for three simple structural engineering phenomena---tension in a cable, bending of a beam, and buckling of a beam---are explored and derived in full. It is rare in STEM to have this ability to observe, understand, and correlate all these aspects of modern engineering problems, and this research serves to capitalize on this unique opportunity. From learning about these problems, it is apparent that they can all be modeled as ordinary differential equations with well-known analytical and numerical solving techniques. This research clearly demonstrates that the practical experimental results are consistent with the theoretical analytical and numerical results, which is a simple but powerful conclusion to draw for STEM education. With these results, new students in the area can easily observe the synergistic effect of how a conceptual phenomenon, rooted in physics and mathematics, can be modeled and proven in real-life with relevant applications.

#### Evolutionary and Sequence Analysis of Putative Genes Associated with Nitrogen Use in Wheat

Joana Tanurahardja Sponsor: Diane Beckles, Ph.D. Plant Sciences

Wheat provides 20% of the calories consumed by humans and is grown on almost every continent on earth. Nitrogenous fertilizer is used to promote wheat yield and quality, but it is expensive, and harmful to the environment, contributing to greenhouse gases and eutrophication of natural waterways. Therefore, improving nitrogen use efficiency (NUE), i.e., the proportion of nitrogen taken up from the soil and converted to wheat biomass is important. Through QTL mapping, a region of the wheat genome potentially associated with NUE was discovered. Some of the genes in this region may be related to nitrogen and nutrient uptake; however, they have not been characterized or, have not been studied in wheat. In this work, we will perform a full bioinformatics analysis of three candidate genes in this region. Evolutionary, sequence and protein analyses will be performed using an array of available tools. These data will build a foundation of the important information needed to help prioritize the genes for functional in-lab testing, to determine their potential contribution to NUE in wheat.

#### Social Development in a Rodent Model of Maternal Autoantibody Related (MAR) Autism

*Allyson Tayag* Sponsor: Melissa Bauman, Ph.D. MED: Psychiatry & Behav Sci

Alterations in the prenatal immune environment are associated with an increased risk of autism spectrum disorder (ASD). Here we present a preclinical rodent model to investigate one potential cause of ASD – maternal autoantibodies targeting fetal brain tissue that are present in a subset of mothers of children with ASD. Although ASD is a uniquely human disorder, animal models can be used to study the effects of maternal autoantibody-related (MAR) autism on social development, which is typically altered in individuals with ASD. In this study, rat offspring exposed to MAR antibodies throughout gestation were compared to control offspring in a social dyad (SD). On post-natal day (PND) 36 (+/- 1 day), test rats (n= 56 MAR-treated, n= 28 control) were assigned to age- and sex-matched stimulus rats and tested together. Interactions were video-recorded and coded to assess social play behavior within each pair by observing the frequency of play behavior (nape attacks) during a 10-minute test. We hypothesize that MAR-treated rats will engage less in social play and exhibit a lower nape attack frequency compared to control rats. Studying the social play behaviors of MAR-treated rats will provide new insight into the neurobiological consequences of prenatal exposure to MAR antibodies.

# Management of Invasive Paterson's Curse (*Echium* plantagineum) Using Herbicides

*River Taylor* Sponsor: Bradley Hanson, Ph.D. Anr Plant Sciences

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

*Liam Tegland* Sponsor: Wolf Heyer, Ph.D. Microbiology & Molec Genetics

Over the course of one's lifetime, DNA damage occurs as a result of both external factors and internal cellular processes. A wide variety of cellular pathways serve to remove or tolerate this damage, promoting genomic stability. MUS81-EME1 is an a DNA-cleaving enzyme, responsible for endonuclease. repairing DNA double-strand breaks - a particularly hazardous form of damage. Although it is non-essential in normal human cells, many cancer cell lines are dependent on the enzyme. I have been working in the Hever laboratory to identify smallmolecule inhibitors of MUS81-EME1 with the potential to be developed into a drug. Our laboratory has developed a fluorescence-based assay to measure the activity of endonucleases which is compatible with high throughput screening (HTS), a technique allowing for the testing of large numbers of small molecules. At present, I am in the process of purifying samples of protein to be used in our next HTS campaign. After the next round of screening is complete, we will further investigate any promising candidates.

# The Effect of Nighttime Chilling Stress on Arabidopsis thaliana Leaf Starch

Natalie Tehranchi Sponsor: Diane Beckles, Ph.D. Plant Sciences

Nighttime chilling stress (NCS) can affect crop yield and quality, hurting agricultural production. Temperature-related stress can result in hindered photosynthetic machinery, thereby affecting plant respiration and growth. In order to combat abiotic stress, more sugar is accumulated within plant leaves to reduce the freezing temperature of the cells within the plant. The source of this sugar is presently unknown. During the day, carbon is accumulated via photosynthesis and is stored in leaves as starch; this starch is then degraded into sugars at night to continue metabolic functions. In this study, it is hypothesized that Arabidopsis thaliana plants subjected to short-term NCS will have decreased levels of leaf starch, as a result of starch conversion to sugar. In order to investigate NCS, plants subjected to 4°C in the stressed condition were compared to the control temperature of 18°C at night. Starch levels were assayed during various intervals over 24-h. If the cold-treated plants have decreased starch, then it is hypothesized that starch was degraded to increase leaf sugar content as a response to the NCS. The data from this experiment will be presented.

#### Genes, Transposons, and Recombination in Selected Plant Genomes

Camille Tenyenhuis Sponsor: Luca Comai, Ph.D. Plant Biology

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

#### **Dear Sister**

Chloe Thepenier Sponsor: Susan Verba, M.F.A. Department Of Design

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

Amanda Thomas Sponsor: Robin Hill, M.F.A. Art & Art History

In "Hand to Mouth," I examine inequities in dental care through the lens of my experience navigating America's dental care system. I use visual art to distill the complex connections between societal forces and personal struggle. Our dental industry prioritizes the vanity of the wealthy over the health of the poor through a broken, inequitable system. From the shortage of dentists who accept Medicaid, to the cost of dental school, to insurance reimbursement rates, to job insecurity, to transportation access, and eventually, to the discrimination, social stigma, and health consequences associated with missing teeth, poor oral health and poverty endlessly feed each other. I seek to illuminate this issue, one of many manifestations of economic injustice in America. My project couples paintings of my mouth, my x-rays in the 19th century photographic process of cyanotype, and other art works incorporating my lost teeth. I seek to bring awareness, evoke empathy, and nullify judgment and shame surrounding this issue. Physical evidence from my body is juxtaposed against statistics and narrative. Dancing the line between beauty and revulsion, I mourn personal loss while celebrating the resilience of the human spirit. The goal of my project is to humanize this public health crisis.

# The Economic Impact of Climate Change on California's Market Squid Fishery

*Kate Thompson* Sponsor: James Sanchirico, Ph.D. Environmental Science & Policy

Market Squid is the focus of this analysis, because of its wellknown association with natural variations during weather events. When ocean temperatures rise, landings fall and the fishery is less lucrative. Eureka port rarely experiences Market Squid landings but did in the 2014-2015 and 2018-2019 seasons due to heightened ocean temperatures in Southern California driving the species further north to find suitable marine conditions. From 1990 to 2013 the average ocean temperature experienced in Santa Barbara waters was 15.88 degrees Celcius, whereas in 2013-2019 this increased to an average of 16.9 degrees Celcius. Looking into the landing numbers for this period and port, Santa Barbara has experienced reduced landing numbers, much below its average of 68 million short tons during this warmer water trend. Most fluctuations in landing numbers can be attributed to changes in sea surface temperature and dissolved oxygen content. Current climate change science predicts that sea surface temperatures will rise .36 degrees Celcius per decade in the latter half of this century. Proactive management strategies to combat variations such as these include using harvest control rules, a quota permit system, and having a ranked vulnerability index for fish stock in order to prioritize investments.

# Quanityfing Hydrogen-Bond Accepting Ability of Organic Molecules Using <sup>19</sup>F and <sup>31</sup>P NMR Spectroscopy

#### *Madison Thompson* Sponsor: Annaliese Franz, Ph.D. Chemistry

Hydrogen bonding is a vital aspect of organocatalysis and many drug receptor interactions. Current methods to measure hydrogen bonds are time-consuming and costly. This research proposes a new method using either <sup>19</sup>F or <sup>31</sup>P NMR spectroscopy, utilizing commercially available, inexpensive pentafluorobenzoic acid (PFBA) or phenylphosphinic acid (PPA) probes. Over 110 medicinally and catalytically relevant molecules and molecule fragments including heterocycles such as pyridines, quinolines, and benzotetramisoles, were examined in dichloromethane with a variety of steric and electronic modifications. In addition, the hydrogen bonding ability of select drug molecules, organocatalysts, and ligands were quantified. Hydrogen bonding measurements showed strong correlations with Hammett parameters and proton transfer basicity (pK<sub>BH+</sub>). Current work is focused on expanding solvent systems in which this method may be employed. Overall, <sup>19</sup>F and <sup>31</sup>P NMR spectroscopy offers a rapid and simple tool to quantify HBA abilities, which will contribute to the understanding of hydrogen bonding in the design of novel bioisosteres and organocatalysts for drug discovery and catalysis.

## Davis Journal of Legal Studies: the Advancement of Legal Discourse, Public Scholarship, and Interdisciplinary Study through Undergraduate Publication

*Emma Tolliver* Sponsor: Lisa-jane Klotz, Ph.D. University Writing Program

In higher education, there is a lack of accessible publication opportunities for undergraduate students, and this lack of opportunity is even more apparent in the fields of social sciences and humanities. With the establishment of Davis Journal of Legal Studies (DJLS), I am working to create an undergraduate, interdisciplinary journal that publishes research related to legal studies; thus, this will provide an opportunity for publication at the undergraduate level. Modeled after UC Davis King Hall Law Review and Stanford Law Review, Davis Journal of Legal Studies seeks to advance undergraduate legal discourse and empower undergraduate students by publishing interdisciplinary legal research. Davis Journal of Legal Studies also seeks to create a community of undergraduate legal scholars and provide valuable experience in academic writing, editing, and research that students can use in their educational and professional pursuits. The journal is a work of public scholarship; it will be publicly and freely accessible online and in UC Davis Shields Library. Volume 1 of Davis Journal of Legal Studies will be published in April 2021. It will be available to read during this presentation.

*Kyra Toomey* Sponsor: Tianhong Li, M.D. MED: Int Med Hem/Onc

Hepatocellular carcinoma (HCC) is a frequent cause of cancerrelated death worldwide and incidence of HCC is rising. Sorafenib and lenvatinib are approved for first-line use in unresectable HCC; however, survival benefit remains low for these therapies. Nivolumab, a human monoclonal antibody to programmed death-1 (PD-1) receptor, has been approved as second-line therapy in patients with unresectable HCC refractory to sorafenib. Indoleamine-2,3- dioxygenase 1 (IDO1) is an intracellular enzyme expressed by numerous human malignancies, including HCC, and has been shown to play a central role in immune suppression within the tumor microenvironment. BMS-986205 selectively inhibits IDO1 without activity against another tryptophan degradation enzyme, tryptophan 2,3-dioxygenase. This project aims to evaluate the combination of BMS-986205 with nivolumab 240mg in unresectable and metastatic HCC. Primary objectives are to evaluate safety and tolerability, and to determine efficacy defined by objective response rate. Secondary objectives are to evaluate disease control rate, duration of response, progression free survival, and overall survival. Patients will be followed for 100 days after the last dose of treatment or until all treatmentrelated clinical toxicities resolve to baseline or grade = 1.

# A Qualitative Analysis: A Look at the Effects of Gender and Cultural Variables in Intimate Partner Violence Among Latinas

Gabriella Torres-Valencia Sponsor: Laura Grindstaff, Ph.D. Sociology

Intimate partner violence (IPV) is considered a global public health issue. The CDC defines IPV as "sexual violence, physical violence, stalking, or psychological harm by a current or former partner or spouse." According to the National Latina Network, one in three Latinas will experience IPV during her lifetime, are less likely to report their abuse and less likely to seek help versus non-Latina women. The two key sociological literatures for understanding IPV represent the "family violence perspective" on the one hand and the "feminist perspective" on the other. The former looks at the family as a subculture with particular norms, values, and practices specific to the family; the latter, by contrast, sees violence against women as an outcome of patriarchal gender relations more broadly. This study aims to expand on the literature by providing an inside look on the gender roles and cultural variables that Latinas must maneuver within their relationship(s) via interviews. I ultimately argue that an intersectional, feminist lens is critical to understanding the experiences of Latinas with respect to IPV, but that, because of the centrality of the "la familia" in Latinx culture, the "family violence" perspective has something to contribute as well.

#### Using CRISPR-Cas9 to Identify Genes Involved in Haustorium Development in Root Parasitic Plants

#### *Tristan Tran* Sponsor: John Yoder, Ph.D. Plant Sciences

Root parasitic plants in the family Orobanchaceae can be devastating agricultural weeds. Our research is directed toward developing a genetic based strategy to control these pests. We use Triphysaria versicolor as a model parasite for this family because it is non-weedy, easy to work with, and amenable to molecular genetic studies. Parasitic plants rely on an organ known as a haustorium to attach, invade, and acquire resources from host plants. We have identified eight genes with predicted functions in haustorium development. To investigate the role these genes play in haustorium development, we are using the genome-editing tool CRISPR-Cas9, to disable the function of these genes. We first transform our CRISPR-Cas9 constructs into T. versicolor roots to introduce mutations in the coding sequences of the target genes. We then evaluate the ability of mutated roots to develop haustoria and observe for any abnormal haustoria development. This research will identify genes and pathways necessary for haustorium development, which could be used to engineer host resistance by silencing haustoria-related genes.

# Operationalizing Social Environments in Cognitive Aging Research

# Duyen Tran

Sponsor: Oanh Meyer, Ph.D. MED: Neurology

"Social and built environments" is a phrase commonly used to refer to social determinants of health (e.g., neighborhood characteristics) that operate at the broad, ecological level. While the "built environment" is clearly operationalized in empirical studies as physical surroundings made by and for humans, the "social environment" remains ambiguous. Theoretical and empirical definitions of social environments have encompassed varied interpersonal (e.g., social network structures) and social exposures (e.g., aggregate measures of socioeconomic status) that operate at different levels of analysis with presumably different mechanistic processes. This scoping review aims to examine how social environments are operationalized and their effects on cognition, cognitive decline, mild cognitive impairment, or dementia. We performed a systematic search on PubMed and Web of Science using MeSH and keyword terms to identify observational/epidemiological studies investigating social environments as a risk or protective factor for late-life cognitive outcomes. Of 7,714 identified studies, 85 met the inclusion criteria based on title and abstract. The findings of these studies will be contextualized within public health, sociological and gerontological theories of social environment and will be used to develop a framework to advance the science of cognitive aging and risk reduction.

Catherine Tran Sponsor: Kristie Koski, Ph.D. Chemistry

Two-dimensional (2D) layered materials have been studied for their unique physical and chemical properties. Their applications range from electronics, energy storage, and catalysis. For this study, the two-dimensional layered materials were grown via vapor liquid solid growth. This process utilizes a horizontal tube furnace where the host's powder deposits onto the substrates as a vapor and cools into a layered material. Upon intercalation of a metal, the layered materials exhibit new and unexpected physical behaviors, including enhanced conduction, altered opto-electronics, and varied structural behaviors. Here, we demonstrate intercalation through eutectic metals into lavered materials including Germanium Sulfide and Bismuth Selenide. A Gallium, Indium, Tin eutectic (Galinstan) is used to intercalate zero-valent atoms into a layered host. In some instances, simultaneous intercalation of the three metals is achieved though selective intercalation is demonstrated depending upon the host layered material. This intercalation chemistry achieves a novel route to place metals inside layered hosts.

#### Nitrate Photodegradation in Snow

*Theodore Tran* Sponsor: Cort Anastasio, Ph.D. Land Air & Water Resources

Deposited snow has shown to be photochemically active as reactions in sunlit snowpacks produce a variety of trace gases. Our focus is on nitrate photolysis in snow which can change its concentration and acts as a tracer for atmospheric pollution in ice cores. Some studies have shown that photochemical reactions occur faster in the guasi-liquid layer (at the air-ice interface) compared to the liquid-like regions (at grain boundaries of the ice matrix) but slowest in aqueous solutions. However, this phenomenon has not been studied in great detail and current studies do not always agree. That is why we want to simulate the reaction in snow which is a truer representation of environmental conditions than simply freezing water. In order to do this, we have built a snow-making machine to: incorporate principles of supersaturated water vapor, form snow crystals, and then introduce chemicals onto the crystals. This sample is then illuminated by an arc lamp filtered to simulate polar sunlight. Overall, nitrate photolysis in snow releases pollutants into the atmosphere which further perpetuates our climate crisis but a better understanding of snow photodegradation will provide greater insight into preventing the progression of climate change.

#### Technical Development and Assembly of a Modular Cubesat

#### Kevin Tran Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

The REALOP CubeSat of the University of California, Davis team utilizes a new design that is modular and provides more access to internal payload components. To achieve ease of accessibility and modularity, the structures team designed mounting brackets and a unique printed circuit board (PCB) housing unit that are easy to modify and reorganize without having to take apart the whole satellite assembly. The assembly preparation team is currently working towards a standardized integration plan that carefully documents the process of assembling each payload component. A database of wellorganized and detailed documents was made to tackle the multiple challenges in developing an assembly procedure that independently integrated each of the critical payload components, PCBs, and wire routes with the structural frame. The assembly will consist of installing deployment switches, payload components and their respective mounting brackets, Xfaces, Y-faces, Z-faces, and finally solar panels. These new designs and standardized integration documents will be used for future CubeSat missions and testing.

## Access to Emergency Contraception and Abortion Pills at **California Family Planning Clinics**

Isabella Trezza Sponsor: Eleanor Schwarz, M.D. MED: Int Med - Genl Medicine

Pregnancy-even when desired-is a risk to a woman's health. Emergency contraception (EC) pills taken within 5 days of sex can prevent pregnancy. Levonorgestrel (Plan B<sup>™</sup>) EC pills are available throughout the United States without a prescription, but the more effective ulipristal (ella<sup>™</sup>) EC pills require a prescription. When undesired pregnancy occurs, abortion pills (mifepristone and misoprostol) can be safely used up to 11 weeks gestation. We assessed Californian family planning clinics' ability to provide EC and abortion pills to women seeking assistance by phone by performing a cross-sectional "secret shopper" survey of a 20% random sample, stratified by county, of clinics participating in California's Family Planning Access Care and Treatment program. Of the 208 clinics we contacted, 71% offered Plan B, 29% provided ella, and 12% indicated they would be able to provide abortion pills if needed. A considerable number of phone staff were not sure how to respond to women calling with a time-sensitive need for family planning services; specifically, 17%, 48%, and 34% did not know if their clinic offered Plan B, Ella, and abortion pills, respectively. Efforts remain needed to increase access to EC and abortion pills for Californian families.

## Barriers, Challenges, And Opportunities For Improving Abdominal Aortic Aneurysm (AAA) Screening In An Open Healthcare System

#### Ashley Truong Sponsor: Matthew Mell, M.D. MED: Surgery

Abdominal Aortic Aneurysm (AAA) screening rates remain low within the at-risk population of 65 to 75 year old men with a smoking history or patients with a AAA family history. The purpose of our study is to determine the barriers to identifying and screening these at-risk patients in an open healthcare system. 1031 at-risk patients were determined via an EMR-based algorithm. Chart review determined 468 (45%) of these identified patients were not eligible for screening. Educational materials and a letter were sent to the remaining 563 patients. Follow-up calls were made to encourage these patients to schedule a screening. 13.1% of the patients had both an invalid address and phone number. 34.1% of follow-up calls were to the wrong number. Successful contact rate was 33.9% and having a PCP increased the chances of successful contact. 101 screening invites were made with 34 (33.7%) scheduling a screening. The most common reason for decline was preference to follow up with one's own PCP. Screening at-risk patients for AAA remains a challenging goal. Collaboration with PCPs, accurate contact information, and a more refined screening algorithm can all play a role in increasing AAA screening rates in an open healthcare svstem.

# Bringing Girls and Gender-Expansive Youth Backpacking to Transform STEM

Jenna Turpin Sponsor: Cynthia Ching, Ph.D. Undergraduate Education

Girls' Outdoor Adventure in Leadership and Science (GOALS) is a free summer science backpacking trip for girls and genderexpansive youth traditionally underrepresented in science, technology, engineering, and math (STEM), who are referred to as scholars in the program. GOALS was dreamed up and created by a group of volunteers from the University of California, Davis in partnership with the National Parks Service. Program evaluation, a committee within GOALS, seeks to understand each scholars' experience of the GOALS trip through analyzing end of trip surveys, scholar journals, Photovoice activities, demographic surveys, and a series of semi-structured ethnographic interviews over time. Once analyzed, this data will reveal if and how scholars' understanding of and identity with leadership, science, the outdoors, and gender were transformed through GOALS. Preliminary findings suggest that particular elements of the GOALS program—specifically related to social relationships and connections to place-facilitated shifts in scholar identity development. Knowing how scholars are transformed by GOALS will improve this program to better serve future scholars, lay the groundwork for similar programs, and ultimately work towards opening up the STEM field to those previously excluded.

#### Characterization of differences in circadian clock function in cultivated and wild lettuce species

#### *Esha Urs* Sponsor: Stacey Harmer, Ph.D. Plant Biology

The plant circadian clock is an important regulatory network that coordinates internal functions with daily rhythmic environmental signals. In some crop species, specific clock gene variants have been selected during domestication. For example, cultivated tomato (Solanum lycopersicum) exhibits a faster period and lower amplitude circadian rhythms which dampen quickly in constant environmental conditions compared to wild relative Solanum pimpinellifolium. Our objective is to determine whether there are similar differences in clock function across domesticated lettuce and wild relative species.

We selected seventeen lettuce accessions which represent each of six morphological classes of domesticated lettuce and six related wild species. First, we assessed differences in the maturation rate of young seedlings from each line to coordinate the developmental stage of tissue used in our assay. To quantify circadian phenotypes we will use Delayed Fluorescence (DF), a high throughput method for measuring circadian fluctuations in autofluorescence of the chloroplasts. We will compare period length, rhythmicity, and the amplitude of the circadian clock across accessions. High functioning clocks will maintain high amplitude and robust rhythms while low functioning clocks will exhibit a dampening signal over time in constant conditions.

# First born Latina daughters: the obstacles when learning from home

*Glenda Valenzuela* Sponsor: Lee Martin, Ph.D. Education

First born daughters in a Latinx household traditionally tend to have more responsibilities than her siblings due to external factors such as culture and pressure from her parents. The aim of this study is to investigate the effect that remote learning has on first born daughters in Latinx homes. We will interview a dozen girls ages 13-18 who fall into this description, then interview one of their siblings within the same age group. We will compare the interviews from both groups to analyze whether culture, gender roles, and birth order affects students' success during a pandemic, where they are forced to learn from home. Students' success will be measured through self-reported end of the year grades and grade point average. We expect there to be a significant difference in learning experiences from both groups, since commonly first born Latinas are given more responsibilities than their siblings. We predict that the first born daughters will struggle more academically than their siblings due to their home and school environment being the same. Their responsibilities and expectations will make it harder for them to focus and prioritize their academics.

# The Influence of Nutrient Limitation on Nucleophagy and Chromosome Stability

Neha Valluri Sponsor: Kenneth Kaplan, Ph.D. Molecular & Cellular Bio

The wide-range of patient outcomes in similarly graded tumors suggests that exogenous factors might influence cancer progression. Dietary strategies that influence nutrient availability might impact genome stability by affecting the ability of the cell to successfully resolve sister-chromatids during mitosis.Failures in sister-chromatid resolution can lead to increases in micronuclei that directly contribute to chromosome instability and inflammatory responses in cancers.Micronuclei that arise from replication stress are predicted to be associated with repetitive DNA elements that are some of the last to replicate and resolve in anaphase(e.g., the rDNA repeats in the nucleolus). The Kaplan lab has observed that replication stress can induce a specialized form of nucleophagy that targets nucleolar-proteins for degradation in the vacuole, possibly as a way to maintain the organization of the rDNA-array in the nucleus and to reduce chromosome instability after replication stress.Interestingly, a similar nucleophagy pathway has been shown to be induced after nutrient starvation, raising the question of whether nutrient availability might impact chromosome stability. We hypothesize that nutrient restriction will enhance protection from chromosome instability following replication stress. To test this, we will use budding-yeast and mammalian cell-culture.We will test the prediction that the structural organization of the nucleolar-proteins are altered under nutrient-limiting conditions.

# Investigating the Response to Health-Related Messages Over Social Media

*Mea Van Staden* Sponsor: Debbie Fetter, Ph.D. Nutrition

In the US, about 7 of 10 individuals use social media to seek out information. However, this widespread use of social media means there is an increased risk of finding false information, especially for health-related topics.

Message framing is a fundamental component of communication strategy that can influence exposure of a message. Messages can be framed to emphasize either the benefits of engaging in a behavior (a gain-frame), the consequences of failing to participate in behavior (a loss-frame), or the potential danger of not adopting recommendations (a fear appeal).

This study will develop gain-framed, loss-framed, and fearbased health messages to investigate the response between a population with high-use of social media versus one with lowuse. Participants will complete a survey about their social media use, perceived level of knowledge about these health topics, and responses to these health messages in the different framings. Questions will be included to measure perceived accuracy, how likely they would be to share the message with their social network, and self-efficacy towards behavior change. The results can be used to investigate how to more effectively disseminate health messages over social media to help individuals adopt beneficial behaviors.

# Examining Speech Toward Alexa versus humans: A comparison of adults and children

### Madeline Vanderheid-Nye Sponsor: Georgia Zellou, Ph.D. Linguistics

Voice assistants such as Alexa and Siri are now commonly used in the home and everyday life, yet our scientific understanding of these interactions is still in its infancy. This study tests how people of different ages (college-age adults and children, ages 7-12) talk to an Alexa device versus a human. The interactions, conducted over Zoom due to social distancing restrictions, were controlled so that participants said the same sentences to the Alexa and human interlocutors. Subjects see a list of 24 words and, on each trial, the experimenter or device asks what the next word on the list is. The subject replies with the corresponding word on their list ("The word is pig"). Then, the experimenter or device says the word back and asks the subject to repeat the sentence; on 4/24 of trials, the interlocutor mishears the pronunciation, saying a second word with a consonant error ("I heard pig or pick"). Videos are annotated in ELAN and manually checked. We predict that adults and children will show differences in the way they adjust their speech for a human versus Alexa interlocutor. Broadly, this work can reveal the impact of voice assistants on language behavior across the lifespan.

# The Impact of COVID-19 on the Mental Well-Being of the Asian Pacific Islander American (APIA) Population Ages 18-30 Residing in Yolo and Sacramento, California

*Zoua Vang* Sponsor: Christian Bohringer, M.D. MED: Anesth & Pain Medicine

Coronavirus disease 2019, or COVID-19, is an infectious communicable respiratory illness that has affected over 100,000 people throughout Sacramento and Yolo County. During the pandemic, social distancing and lockdown measures were put in place to ensure the safety of our communities. Mental health issues have become relatively common in the youth group due to social isolation. Our aim is to investigate, to what degree has COVID-19 impacted the mental well-being of the Asian & Pacific Islander American (APIA) community, ages 18-30, residing in the Yolo County and Sacramento City/County, CA region compared to the Caucasian population? Our online survey asks participants to rate statements based on their mental health, healthcare access, and academic performances. Our survey was opened from January 20th, 2021 to February 3rd, 2021. Our sample group (n=147) consisted of 32 participants identifying as Caucasian and 94 participants identifying as Asian/Pacifier Islander. Our data suggest that Caucasian and APIA communities are experiencing depressive symptoms. However, the APIA community reported having a higher impact of negative effects related to depression, anxiety, mood, and stress levels. In conclusion, there should be more resources to support the APIA community regarding their mental well-being, especially during this time.

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

#### *Mikka Vapor* Sponsor: Ga young Chung, Ph.D. Asian American

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

# Bioprinting Transgenic Rice Cells for Production of a Recombinant Biodefense Agent, Butyrylcholinesterase

Anika Varma Sponsor: Karen Mcdonald, Ph.D. Chemical Engineering

Bioprinting of plant cells provides a novel platform for production of biotherapeutics like butyrylcholinesterase, a human blood protein that can bind to and inactivate organophosphate nerve agents. In the McDonald-Nandi Lab, we grow transgenic rice cells that produce recombinant rice butyrylcholinesterase (rrBChE) in suspension culture upon sugar starvation. In this research, we develop a specialized bioreactor system that retains cells in a solid hydrogel matrix, which may offer benefits like reduced cell aggregation, controlled nutrient mass transfer, easy medium exchange, and improved product recovery. Immobilized cells and cells in suspension are maintained for 14 days through one growth-expression cycle. Viability is assessed by an absorbance-based triphenyl tetrazolium chloride viability assay, and sugar levels are measured on a YSI analyzer. Active rrBChE concentration is measured using a Modified Ellman Assay, and total soluble protein is calculated from a Bradford Assay, to determine secreted protein in media and intracellular protein in crude cell extract. Protein profiles and rrBChE are further visualized with SDS-PAGE and Western Blot. Our results are promising, showing comparable viability and productivity between cells retained in hydrogel and control cultures grown in liquid suspension. This incentivizes further experimentation and scaleup of bioprinting technology for continuous manufacture of biotherapeutics.

#### Development of a Rotational Testbed for CubeSat Imaging Slew Requirements

#### Aashay Vartak Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

This presentation discusses the research and development of a motorized rotation testbed to define reaction wheel slew requirements in support of UC Davis' REALOP CubeSat mission. One critical goal of the REALOP mission is to capture clear images of the Earth from low Earth orbit (LEO), requiring finely tuned attitude control from the on-board reaction wheels to limit motion blur. This performance requirement was investigated using a microstepping motor to simulate a one degree-offreedom rotational environment for testing the image quality of a Raspberry Pi V2 Camera Module. Through varying the camera's angular velocity, exposure, and ISO, images were captured and then qualitatively analyzed to determine the rotation threshold that the satellite's reaction wheels must maintain to return clear pictures from LEO. Experimental results found a maximum rotation rate of 20°/s and an exposure time of 100 µs at ISO 200 suitable for successful imaging efforts. While the motor step resolution constrained the rotational smoothness of the testbed, this design demonstrates a low-budget option for student teams investigating CubeSat imaging attitude control requirements. The use of an environment more similar to that of LEO, such as a frictionless air-bearing table, is recommended to better simulate unconstrained rotation.

# Factors Influencing the Appeal of Ethno-racially Diverse Schools

Preetha Vellayapan Sponsor: Jacob Hibel, Ph.D. Sociology

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

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

Rasika Venkatesh Sponsor: Luis Carvajal-Carmona, Ph.D. MED: Biochem & Molecular Med

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

#### Thyroid Hormone-induced Lower Jaw Remodeling in Xenopus tadpoles: Effects of Retinoid-X Receptor Ligands and Roles of Thyroid Hormone Receptor isotypes.

*Lara Vetter* Sponsor: John Furlow, Ph.D. Neuro Physio & Behavior

Thyroid hormone (TH) signaling plays critical roles during vertebrate development, including regulation of skeletal and cartilage growth. Thyroid Hormone receptors (TRs) heterodimerize with Retinoid-X receptors (RXRs) to regulate gene expression, but RXR ligands do not appear to affect TH signaling in adults. Amphibian metamorphosis, especially in Xenopus laevis, the African clawed frog, is a well-established in vivo model for studying the mechanisms of TH action during development. We have shown that RXR ligands potentiate TH competence in certain tissues using a precocious metamorphosis assay. In this study, we focus on the jaw that undergoes dramatic TH-mediated remodeling during metamorphosis to support new feeding and breathing styles. Using a battery of approaches including quantitative morphology, differential gene expression and whole mount cell proliferation assays, we show that both pharmacologic (bexarotene) and environmental (tributyltin) RXR agonists potentiate TH-induced responses but are inactive in the absence of TH; the RXR antagonist UVI-3003 inhibits TH action. Our results particularly implicate matrix metalloproteinase expression in jaw remodeling and RXR ligand potentiation. We also present preliminary data using TALEN induced TRB mutant tadpoles to distinguish the roles of the two TR isoforms (a and ß) in TH action and RXR ligand effects in the lower jaw.

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

#### Victoria Vicu�a Sponsor: Christina Rulli, Ph.D. Philosophy

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

#### Building an App to Promote a Sense of Belonging for UCD Students

**Abigail Vigil** Sponsor: Kali Trzesniewski, Ph.D. Anr Human Ecology

The purpose of this study is to provide representation for the struggles that students may face in their transition to college. To attempt to help represent all backgrounds and common struggles, we have created "belonging stories" of how previous students have dealt with these experiences. The Belonging Team is working towards developing a mobile app for all UC Davis students to read these stories and feel more connected and supported. With help from our design team on the app, we've created a Prototype that has allowed us to gain feedback from current UC Davis students through focus groups and online surveys, due to the recent change to online format. We sought out to see how beneficial the app is, how user-friendly the app is, and what additional resources we may be able to add. As we gather more information on accessibility, aesthetic, and impact of the stories, we are editing the app and gathering research so that this app can be as effective as possible. Our goal is create an app that allows students to feel like they belong to UC Davis, and offer it in an easily-digestible way with appropriate resources that accompany it.

#### Brittany Villalpando Sponsor: Monica Torreiro-Casal, Ph.D. Chicano Studies

In California, the topic of incarceration and recidivism has long plaqued marginalized communities for generations. A multitude of attempts at reform has brought both success and failure. There has been a disconnect between activists and policymakers on how to address this crisis. Currently, there has been documented evidence and research on already established alternative routes to addressing the issue at hand, however, a new approach has been producing promising results. The work conducted by one Sacramento based organization called Self Awareness and Recovery utilizes their original Self Awareness and Recovery Model as a tool to bring effective change within their community. The use of lived experiences and trauma-informed care from Self Awareness and Recovery have laid a path in the right direction to improve the lives of "at-risk youth" and formerly incarcerated individuals within Sacramento County. This study aims to unveil the lived experiences of formerly incarcerated youth and adults by collecting personal testimony through one-on-one interviews. The findings from this research will contribute to connecting activists and policymakers, to create an effective reform to incarceration and recidivism.

## The Effect of Warm Interactions between Siblings on Educational Attainment

*Elsie Villanueva* Sponsor: Jonah Cox, Ph.D. Human Ecology

This study seeks to assess how parental hostility affects educational outcomes, also looking at the impact of sibling warmth. We draw our data from the Iowa Youth and Family Project, a longitudinal study began in 1989 when the target children were in 7th grade and continuing through young adulthood. Recorded family interactions were coded for dyadic hostility and warmth between each of the family members. For the purposes of our analyses, we looked at educational outcomes by assessing how many years of education the target children achieved by the age of 25, controlling for 7th grade GPA, family per-capita income levels, and parental education levels. The overall model was significant. Observed maternal hostility held a significant and negative effect on education levels, while father's observed hostility was not significant. Sibling warmth approached significance, with a positive effect on education outcomes. From these preliminary findings, it does appear that educational attainment is not only dependent on one's academic experiences but also may be affected by the relationship between parent and child as well as between siblings. Further analysis will help determine if maintaining a positive relationship with one's siblings may serve as a buffer against lack of emotional support from parents.

#### Returns to Agricultural Technology in Rich and Poor Countries

*Alexis Vivas Flores* Sponsor: Ashish Shenoy, Ph.D. Ag & Resource Economics

The implementation of agricultural technology techniques is the "perfect" solution to improve the potential and efficiency of crops in countries around the globe that have different land quality. There may be some natural production differences in crops, but these differences may be intensified because of more direct research in some crops than others. In this project, we will explore the land quality and crop choice in both rich and poor countries where we will test the hypothesis that the returns to technology are greater for crops that grow in rich countries. Assuming this hypothesis is correct, we will then quantify how much directed research contributes to the agricultural productivity gap between rich and poor countries by computing the difference between maximum potential yield for high-andlow investment. Our quantitative methods include running linear regressions using data from our main sources FAO GAEZ database, and data on national wealth from the Penn World Tables. Our research will contribute to the field by reinforcing the idea that research is an essential tool in a given country before implementing agricultural technology.

## The Role of AXL Tyrosine Kinase in the Tumor-Immune Microenvironment of Melanoma

Allyson Walsh Sponsor: Amanda Kirane, M.D. MED: Surgery

Recent evidence suggests AXL receptor tyrosine kinase (RTK) has been associated with a number of human cancers, including melanoma, but its role in evasion of immune surveillance and response to immunotherapy has not been well defined. Therefore, we aim to examine the mechanisms by which AXL RTK mediates resistance to modern therapies in melanoma. Clinical data for metastatic melanoma patients were downloaded from the GDC legacy archive. Biomarkers were defined as "high" or "low" expressions in each patient. In vitro assays were conducted to examine the effect of AXL inhibition on melanoma tumor cell expression and function. The results show that stage IV patients responding to Pembrolizumab demonstrated significantly lower AXL levels compared to nonresponders. However, in the overweight population, high AXL expression was associated with improved survival. The data suggest that AXL activity is associated with melanoma cell behavior and immunologic response in melanoma patients. AXL appears to mediate response in the obese population by a macrophage driven mechanism as opposed to T cell mediation. Further definition of the potential therapeutic impact of AXL directed targeting in melanoma is warranted.

# Effect of Starch Branching Enzyme Gene Variants on Starch Digestibility and Quality Metrics in Tomato (Solanum lycopersicum L.)

*Keqing Wang* Sponsor: Diane Beckles, Ph.D. Plant Sciences

Starch is pivotal to plant growth and development and influences crop yield and postharvest quality. It has been traditionally, and extensively studied in cereal and tuber crops; however, a significant knowledge gap remains of its role in fruits, leafy greens, and vegetables which are important sources of nutrients and antioxidants in the human diet. Tomato is a popular global commodity in the world. Surprisingly, tomato fruit at the Mature Green stage contains a substantial amount of starch up to 40% of fruit dry weight which is then degraded to sugars during fruit ripening. It is known that Starch Branching Enzymes (SBEs) are a determinant of starch crystallinity, which regulates starch digestibility to sugars. However, it is not known how variation in starch digestibility would influence sugar content and the physiological and metabolic pathways that depend on sugars. Our goal therefore is to create tomato fruit varying incrementally in starch digestibility, by reducing the expression of two SBE genes using CRISPR/Cas9. We expect that because starch breakdown contributes to fruit sugars, fruit sweetness and the sugars needed for growth maintenance would be affected, ultimately influencing fruit quality and shelflife, factors that determine postharvest waste and loss.

### Effect of Starch Branching Enzyme Gene Variants on Starch Digestibility and Quality Metrics in Tomato (Solanum lycopersicum L.)

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#### Felicia Wang

Sponsor: Yuuko Tonkovich, Ph.D. Education

Past studies have shown that parents' openness in emotion talk (ET) with their child can facilitate a stronger sense of control in the child's emotion regulation (ER). ET is the use of emotion language (e.g. emotion words, emotion questions) and plays a crucial role in socializing emotion understanding and behaviors. ER encompasses all processes in monitoring, understanding, and modifying one's reactions to the outside environment in an effort to accomplish one's goals. However, there is less research with families of diverse cultural backgrounds. To address the gaps in previous research, this study examines differences in cultural groups and the associations between ET and children's ER with Mexican-American (MA) (N=46) and Chinese-American (CA) (N=44) families from Head Start. Parents were asked to read a picture book, "Frog, Where Are You?" to their child. Children's ER was assessed by the Transparent Box task, a frustration eliciting task. Preliminary results show significant differences in ET between MA and CA parents with MA parents showing more ET than CA parents. Preliminary findings also show associations between parents' negative words and child's persistence during the Transparent Box activity. These results suggest possible cultural differences. Implications will be discussed.

# Pollen Tube Growth in *Medicago sativa* (alfalfa) in Response to Compatible and Non-compatible Rhizobia

Parker Wheeler Sponsor: Alison Berry, Ph.D. Plant Sciences

Nodulating plants participate in a symbiotic relationship with soil bacteria that fix nitrogen, an essential nutrient for plant growth. Host-specific bacteria initiate nodulation by modifying growth of root hair cells, using an exchange of signals. By characterizing the relationship between root hair growth and bacterium, we may better understand how to encourage nodulation and promote plant growth, reducing the need for nitrogen fertilizers. To mimic this response, pollen tubes were used as a model for root hairs, since both pollen tubes and root hairs exhibit tipbased growth, and pollen tubes are single cells, making them easier to manipulate. Germinating Medicago sativa (alfalfa) pollen grains were inoculated using two bacterial strains, Sinorhizobium meliloti (a nitrogen-fixing symbiont that is compatible with M. sativa) and Rhizobium etli (a nitrogen fixing symbiont non-compatible with M. sativa). We found that pollen grains inoculated with S. meliloti produced pollen tubes at a rate of 66% ±15, while pollen inoculated with R. etli produced pollen tubes at a rate of 40% ±13, and uninoculated produced tubes at a rate of 17%  $\pm$ 17. This suggests that 1) both bacteria stimulated pollen tube growth, and 2) signaling by the symbiotically compatible strain may induce an increased growth response.

#### Bioinformatics Analysis of Novel Genes Associated With Tomato Fruit Postharvest Quality

Parker Wheeler Sponsor: Diane Beckles, Ph.D. Plant Sciences

Tomatoes are universally popular, high in fiber and antioxidants, and are revered for the 'authenticity' they add to many cultural dishes. However, consumers have expressed unhappiness with the quality of store-bought tomatoes, because trades-offs made with respect to enhancing shelf-life and optimizing quality. To prolong shelf-life, tomatoes may be harvested before they reach full ripe and stored for variable periods before consumption, conditions that destroy fruit quality compared to fruit harvested when ripe. The genes that are affected by different postharvest storage conditions have not been fully characterized, but a better understanding of their mode of action may help to improve tomato quality. Transcriptomics and methylomics were used to identify genes whose expression changed in concert with changes in tomato fruit quality due to different postharvest handling. Several differentially expressed genes were identified, many of which have not been previously implicated in tomato fruit quality. In this work, we initiated a bioinformatic analysis of these genes and their cognate gene families, in tomato and other species, to determine if they are universally involved in fruit quality or ripening. This is the first step towards their functional analysis in fruit, using reverse genetics approaches, and long-term improvement in commercial fruit guality.

# Better Together: Identifying Human CTP Synthetase Partners Involved in Intracellular Transport and Regulation

Jan Wignall Sponsor: Enoch Baldwin, Ph.D. Molecular & Cellular Bio

CTP synthetases (CTPSs) are conserved enzymes that catalyze the final step in de-novo pyrimidine biosynthesis. Defects in human CTPSs can cause immunodeficiencies while selectively controlling their activity could be used to treat autoimmune disease. CTPSs have an elaborate regulatory network, with a more unusual aspect being reversible formation of micron scale polymeric filaments. These filaments alter enzyme kinetics and are vital for regulating CTP production. Fluorescently-tagged hCTPSs expressed in MCF10A human breast cells form two distinct structures that are dynamically transported throughout the cytoplasm: small puncta and large rods. The large rods colocalize with other polymeric filaments, such as IMPDH2, a purine biosynthetic enzyme, but a complete list of partners is unknown. We hypothesize that hCTPSs directly interact with proteins involved in their transport and regulation, or with proteins under the same metabolic control. To identify interacting proteins, we will perform immunoprecipitation followed by mass spectrometry, testing variables such as crosslinking and growth conditions. Direct observation of RFPtagged candidates colocalizing with hCTPS1-CFP or hCTPS2-YFP in MCF10A cells will provide further evidence for their interaction, with IMPDH2-RFP as a positive control. Determining CTPS interactors will reveal dynamic localization purpose and mechanisms, and unmask novel regulatory networks controlling pyrimidine biosynthesis.

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

*Jennifer Wijaya* Sponsor: Juliana Leite NobregaDeMouraBell, Ph.D. Food Science & Technology

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

## Does the Nature of Rotation Matter? Assessing Infants' Mental Rotation in an Online Task.

Amanda Wilheim Sponsor: Lisa Oakes, Ph.D. Psychology

Mental rotation, which is the ability to mentally manipulate and make predictions about an object's orientation, is critical for understanding objects in our daily lives. Previous studies have revealed sex differences during infancy, specifically that boys show greater mental rotation than girls (Moore & Johnson, 2008; Quinn & Liben, 2008, Lauer et al., 2015). The goal of the current study was to assess how the nature of the rotation influences infants' mental rotation. We tested infants using an online platform called Lookit (Lookit.mit.edu) that allows families to participate in studies from home. One-hundred-fifty infants between the ages of 6 and 13 months were tested in a modified version of the task used by Lauer et al. In that task, infants were shown two stimulus streams containing identical tetris-shaped items that repeatedly appear and disappear. On every third presentation one stream contained the mirror image of the item in the other stream. We manipulated the nature of rotation by presenting some trials in which the items rotated sequentially (i.e., continuously and clockwise); the remaining trials were nonsequential and random. Ongoing analyses will allow us to evaluate previously observed patterns in mental rotation tasks, including age and sex-related differences.

# Validating the Use of an Electrified Gate for Measuring Motivation for a Food Reward in Feedlot Cattle

Kayla Wilkerson Sponsor: Cassandra Tucker, Ph.D. Animal Science

The primary objective of this study is to validate the use of an electrified gate for measuring motivation for a food reward. Six cohorts of 4 steers will be fed a transition diet (18% forage) and one of 3 treatment diets (n=8/treatment) in automated feed bins that measure intake: 1) an empty bin, 2) an additional offering of primary diet, or 3) a corn and molasses food reward. The primary diet bin will have an unelectrified wooden gate and the treatment bin will have an electrified wooden gate. The current on the electrified gate will be increased exponentially (starting at 0 µA and reaching a maximum of 5000 µA) every two days so long as the animal successfully accesses the bin in the previous 48 hours. We expect cattle provided with a food reward will show less latency, access the food reward more frequently, and tolerate higher maximum currents compared to the cattle provided with an additional offering of their primary diet or an empty bin behind the electrified gate, suggesting motivation to access the food reward.

# Yield Effects of Drought Tolerant Maize in Sub-Saharan Africa

*Miranda Willard* Sponsor: Stephen Boucher, Ph.D. Ag & Resource Economics

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

#### *Elena Willow* Sponsor: Eleanor Schwarz, M.D. MED: Int Med - Genl Medicine

Subdermal and intrauterine contraceptives are safer and more effective than birth control pills. California's Family Planning, Access, Care, and Treatment (FPACT) program offers free contraceptive services to individuals living at or below 200% of the federal poverty level. To assess the proportion of FPACT clinics currently providing intrauterine and/or subdermal contraceptives, we performed a "secret shopper" study of a 20% random sample, stratified by county. Of the 2,200 clinics listed on the FPACT website. located in 53 counties, we aimed to contact 325, and successfully collected data from 183. Most (61%) clinics reported offering both subdermal and intrauterine contraceptives, 9% only offered intrauterine contraceptives (IUC), and 2% only offered subdermal implants; 18% did not offer either, and 10% had staff that were uncertain of the contraceptives offered. Among clinics offering IUC, 3% only offered hormonal IUC and 36% offered both copper and hormonal IUC; 61% offered IUC but were unsure of the type. These findings indicate that a considerable number of family planning clinics in California are not currently providing the safest and most effective contraceptives. Further training of clinic staff is needed to ensure that all Californian families have access to the full range of contraceptive methods.

#### Investigating the Energy Consumption of Cell-Free Protein Synthesis Systems Using an ATP/ADP Biosensor

*Matthew Wong* Sponsor: Cheemeng Tan, Ph.D. Biomedical Engineering

Unlike the traditional way of producing proteins using living cells, cell-free protein synthesis systems represent a novel way to synthesize proteins in vitro. Cell-free systems are constructed from the bottom-up using biological machinery critical to protein synthesis. They also have many advantages over in vivo protein production, including rapid protein expression, direct manipulation of the reaction conditions and their ability to synthesize toxic proteins. Since cellular energies are essential components in protein synthesis, understanding and controlling the energy consumption are essential for enhancing cell-free systems. Here, we purify Perceval, an ATP/ADP ratio biosensor, to investigate the energy consumption of cell-free systems. We characterize Perceval's response to different concentrations of only ATP or ADP, and different ATP/ADP ratios. We also investigate how the presence of different rNTPs at different concentrations affects the specificity of Perceval's response. Finally, we discuss how this biosensor can be applied to cellfree systems to investigate their energy consumption. Our work has broad impact on understanding and controlling the energetics of cell-free protein synthesis systems.

#### Jordan Wong Sponsor: Stephen Robinson, Ph.D. Mechanical & Aerospace Engr

REALOP is the first UC Davis undergraduate-based CubeSat team with a launch scheduled for late 2021. Under mission REALOP, the Structures team has developed a cable harnessing model and prepared a process for manufacturing. More specifically, the parts preparation subteam is responsible for manufacturing preparation as well as creating validation and verification documents. The cable harnessing subteam is responsible for acquiring cable lengths and organization for use in electrical wiring. For parts preparation, drawings of every component as well as tolerances were made for use in manufacturing. Then Interface and Control Documents (ICDs) were developed to detail how each component interfaces with one another during assembly. Mechanical Part Inspection Documents (MPINs) were also created to verify if the manufacturers made the components correctly. For the cable harnessing subteam, Solidworks was used to provide a reasonable representation of the wiring in the CubeSat in order to obtain wire lengths. Drawings of the wire lengths were then generated for use by the electrical team. Both teams in tandem provide a basic schematic of how the CubeSat is assembled, but more importantly also expose members to the documentation and practices that go into spacecraft development, increasing the efficiency of developing future CubeSats.

# Talking to Babies: Does What You Say Matter?

Wai Yan Emma Wong Sponsor: Katharine Graf Estes, Ph.D. Psychology

It seems instinctive for adults to use infant-directed speech (IDS) when speaking to infants-they raise their pitch, slow their speech, and exaggerate their intonation. Acoustic features have shown significant impacts on infant word-learning (Ma et al., 2011), but elaboration may also play a role. While a study has shown that repeating words facilitates word-learning (Maura et al., 2020), elaboration could also be important for language acquisition by exposing infants to the context of words. This study will examine the difference between repetition and elaboration of IDS and its relationship to infants' vocabulary development. Twenty American-English speaking parent-child dyads participated in a set of interactive tasks that contained objects labelled with target words. Audio recordings will be analyzed for the frequencies of target words spoken (e.g. cow) and additional descriptors used per object (e.g. "cows make milk"). We also collected parental reports of infant vocabulary size. We predict that infants whose parents use additional descriptors will have larger vocabularies than infants whose parents use more isolated repetitions of target words. We propose that elaborations are important because it diversifies word exposure. Understanding the role of repetition and elaboration in IDS is important because they may facilitate infant language acquisition.

#### A Physiological Study of Seedlings' Growth Response on High NUE Wheat Under Nitrogen Stress

Cheng Lam Wong Sponsor: Diane Beckles, Ph.D. Plant Sciences

The use of nitrogen (N) fertilizer in agriculture is fiscally expensive and, creates many environmental problems. Wheat is a staple food that requires a high N-application for maximum productivity. Thus, increasing wheat N-use efficiency (NUE) is essential to minimizing the amount of N used. Previous studies have found a quantitative trait locus (QTL) in wild wheat that could be related to higher NUE but, the physiological basis and growth response under N stress is still unknown. We will use a semi-hydroponic system to study and characterize the physiology and growth of different wheat genotypes under a sufficient and low N environment. The physiological parameters (e.g., root and shoot length, biomass, etc.) of introgression line, 99 (IL-99), which contains the additive QTL for high NUE, will be measured and compared to the low NUE parent (RUTA). We expect to see poorer growth parameters under a low N environment, but that IL- 99 should show better growth under N stress. This study will provide the information for the growth response of line 99 seedlings under low N stress.

## Utilizing Treatment Data to Categorize Platinum-Based Chemotherapy Resistance

Sydney Woods Sponsor: Jeremy Chien, Ph.D. MED: Biochem & Molecular Med

Standard ovarian cancer treatment involves surgical resection of tumors followed by a primary adjuvant treatment which utilizes a combination of platinum-based and taxane chemotherapeutics. Researchers have found that many patients develop resistance to platinum-based drugs, making optimization of treatment plans extremely difficult to accomplish. To advance a better understanding of chemotherapy resistance in patients, it is important to accurately categorize patients with differential response to treatment. We will curate existing ovarian cancer patient data from The Cancer Genome Atlas (TCGA) database to categorize patients into three groups: platinum-refractory patients, who experience progression during treatment; platinum-resistant patients, who experience progression within six months of ending treatment; and platinum-sensitive patients, who do not experience progression for at least six months after ending treatment. Relevant patient data such as drug names and dates of progression events and treatments will be downloaded, standardized, corrected for typographical errors, and then utilized to categorize each patient according to their response type. The data will then be filtered for those who have received a standard treatment to serve as comparison groups upon which to perform a comparative genomic analysis for identification of any genetic factors and biological pathways that are associated with differential patient response to chemotherapy.

Katherine Woodworth Sponsor: Sarah Yarnell-Hayes, Ph.D. John Muir Institute-environ

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

# Innate Immune Responses in Sustentacular Cells and Olfactory Sensory Neurons Against Viral Pathogens

*Garrett Wu* Sponsor: Qizhi Gong, Ph.D. MED: Cell Biology & Human Anat

The nasal mucosa is exposed to the environment and pathogens. Within the nasal mucosa and inside the olfactory epithelium (OE), pathogens may use olfactory sensory neurons (OSNs) as a direct route to the brain, causing neurodegenerative diseases. Despite this susceptibility, the mechanisms of viral defense from different cell types within the OE have not been extensively studied.

Viruses are pathogens that hijack host machinery to replicate. Within the olfactory epithelium, there are two major cell types that act as the initial barrier, sustentacular (Sus) cells and OSNs. Based on evidence from literature and studies from our lab, it is hypothesized that Sus cells have abilities for innate immunity and preventive function to protect OSNs. Being a neurotropic virus, our model virus vesicular somatic virus (VSV) is capable of infecting OSNs and Sus cells. However, it is unknown if VSV replication is controlled in these cell types. This study tests the hypothesis by examining temporal innate immune responses in Sus cells after VSV infection and comparing VSV replication rates with dsRNA levels, in Sus and OSNs.

This research aims to identify cellular and molecular players critical for controlling viral replication and spread so that we can develop strategies against viral infection.

#### Arista Wu Sponsor: Ozcan Gulacar, Ph.D. Chemistry

Questions in assignments for students are often grouped by chapter, topic, or concepts. The structure shows a great emphasis on categorization. Practice problems in chemistry textbooks are mostly organized by sections to help students navigate the assignments and practice in order; however, exams usually test students with problems from a series of chapters in a mixed format. Therefore, there is a mismatch between what students practice on and how they are tested. The goal of this study is to examine the structure of the assignments on students' problem-solving performances. The study uses scientific control method and divides students into two groups throughout three experiment sessions. Each group had interventions with same length and identical questions but different structures. The experimental group had mixed questions, while the control group had questions organized based on chapters and topics. This study is critical in studying students' learning abilities with mixed and categorized problems. The findings could help UC Davis instructors to better structure their teaching materials to help improve students' problem-solving abilities. Given most textbooks and instructors tend to organize and classify content for students to navigate the knowledge base, this study is important to assess the effectiveness of the traditional teaching method.

#### Deep Learning for Pre-Operative Tumor Segmentation

*Kajetan Wysoczynski* Sponsor: Jinyi Qi, Ph.D. Biomedical Engineering

Computed tomography is commonly used for diagnosing cancer. Radiologists perform routine work delineating tumors, which is prone to inconsistencies. One practice is image segmentation - outlining an area of interest on a scan, such as a tumor. Artificial intelligence in surgical oncology augments the performance of surgeons and radiologists, assisting in proper diagnosis and improving surgical outcomes. We implemented a convolutional neural network (CNN) with U-Net structure using Tensorflow and Keras packages. The model delivers promising performance resulting from multi-channel feature maps and five distinct levels. Given a preoperative CT scan, CNNs can autonomously trace the outline of a malignant tumor in the form of a mask image, which shows medical professionals a visual of cancerous tissue. The CNN is trained from a dataset comprising 96 head and neck tumor patients, appended by surgical outcomes and confirmed cancer status to reduce error. This Albased approach provides custom, patient-specific guidance for the shape and size of the tumor, which can reduce human error occurring during the preoperative diagnosis stage. The technology has great potential to assist surgeons in making the right incisions, as well as reduce the incidence of radiologic mistakes during diagnosis.

# Exploring the Function of Putative Type VI Secretion System Effectors in *E. coli*

*Elva Xian* Sponsor: Tiffany Lowe-Power, Ph.D. Plant Pathology

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

# What are the Roles of Pitch Variation and Word Repetition in Infant Vocabulary Development?

*Yuxuan Xiang* Sponsor: Katharine Graf Estes, Ph.D. Psychology

Infant-Directed Speech (IDS), also known as baby-talk, is characterized by higher pitch, longer word duration, a wider pitch range, and more word repetition in comparison to Adult-Directed Speech (ADS). Prior research suggests that components of IDS affect infants' language learning. However, we do not yet know how certain linguistic elements, such as varying pitch and word repetition, contribute to infants' vocabulary development. The current study will investigate whether infant vocabulary size correlates with parents' pitch range and/or the number of target word repetitions the parent produces. We will analyze audio recordings of monolingual English-speaking parents playing with their infants (n= 24, ages: 10-12 months) in a task designed to elicit 14 target words (e.g., hat, apple, boat). We will count repetitions of each target word and measure the pitch range for these target words for each participant. We will collect infant vocabulary size via parental reports on a standardized vocabulary form. We expect that parents with high rates of target word repetition and wide pitch ranges will have infants with the largest vocabularies. If confirmed, these findings would suggest that certain characteristics of IDS can be targeted to promote better linguistic development in infants.

#### An Automatic GitHub Takedown Tool for Educational Purposes

Zesheng Xing Sponsor: Joel Porquet, Ph.D. Engr Computer Science

CS students frequently post their programming homework on GitHub repositories. Though most of the time publishing these repositories is meant to be used as a portfolio for job applications, it often violates instructors' copyright or provides solutions for future students who might then plagiarize from them and violate the university's code of conduct. To prevent programming homework solutions from being posted online, instructors have to invest a large amount of time to search for these repositories and then send individual emails to students asking them to take their repositories down. In order to streamline this tedious process, we designed and implemented an automatic takedown script. This script allows instructors to find repositories containing programming homework solutions, track their status over time, and send emails to students, just by typing a few commands in the terminal. We are hoping this tool can help CS instructors save time while increasing the accuracy of the takedown process.

## The Impact of Stress on Morphine Preference and Consumption

Christine Xu Sponsor: Brian Trainor, Ph.D. Psychology

There are several factors to consider when analyzing the risks behind substance abuse. One such component behind an individual's likelihood to develop substance use disorder (SUD) is the sensitivity to stress and its influence on behavior. To test this, we used California mice (Peromyscus californicus) as a model to study social stress due to the aggressive nature from both male and females mice. After putting male and female California mice through social defeat stress or a control condition we examined the effects of social stress on morphine preference. We first put them through four days of the forcedchoice paradigm. During this acclimation period, two identical bottles of morphine are introduced to the mice. After that, one of the bottles is replaced with quinine water and the mice are then presented with a choice between morphine and quinine water. Preliminary results from 32 mice (16 males and 16 females) showed that while on average stressed mice increased morphine consumption during the forced-choice paradigm, this difference was not statistically significant. Surprisingly, stress had no significant effect on morphine preference. Further study is needed to determine how dosages and self administration schedules interact with stress to affect morphine preferences.

*Reesha Yadav* Sponsor: Charan Ranganath, Ph.D. Psychology

Why do we remember some things and not others from the same event? Research has found that over time, central details (CD) of a narrative are better retained than peripheral details (PD), though it is unclear which regions of the brain are responsible for this memory retention. Our study attempts to investigate how memory for events changes over time and identify the brain regions associated with retention. Participants in this study watched two short-movies while undergoing an fMRI scan. One of the movies was recalled immediately and the other was recalled after a 2-day delay. Then, the audio recordings of the recalled movies were scored for CD and PD. Using the scored recall, we calculated the correlation between brain activity during movie viewing and the quality of subsequent retrieval. Our behavioral findings were congruent with prior research - participants remembered fewer details after a 2-day delay compared to the immediate delay with CD better preserved over the delay than PD. Interestingly, we found hippocampal activity at the event boundaries during encoding correlated with memory for CD at the 2-day delay, but not the initial recall. This data suggests that hippocampal activity is important for retention of the gist of events.

# The Impact of COVID-19 on the Mental Well-Being of the Asian Pacific Islander American (APIA) Population Ages 18-30 Residing in Yolo and Sacramento, California

Pahoua Yang Sponsor: Christian Bohringer, M.D. MED: Anesth & Pain Medicine

Coronavirus disease 2019, or COVID-19, is an infectious communicable respiratory illness that has affected over 100,000 people throughout Sacramento and Yolo County. During the pandemic, social distancing and lockdown measures were put in place to ensure the safety of our communities. Mental health issues have become relatively common in the youth group due to social isolation. Our aim is to investigate, to what degree has COVID-19 impacted the mental well-being of the Asian & Pacific Islander American (APIA) community, ages 18-30, residing in the Yolo County and Sacramento City/County, CA region compared to the Caucasian population? Our online survey asks participants to rate statements based on their mental health, healthcare access, and academic performances. Our survey was opened from January 20th, 2021 to February 3rd, 2021. Our sample group (n=147) consisted of 32 participants identifying as Caucasian and 94 participants identifying as Asian/Pacifier Islander. Our data suggest that Caucasian and APIA communities are experiencing depressive symptoms. However, the APIA community reported having a higher impact of negative effects related to depression, anxiety, mood, and stress levels. In conclusion, there should be more resources to support the APIA community regarding their mental well-being, especially during this time.

The Influence of Classroom Language Environment on Bilingual Language Proficiency: Mexican-American and Chinese-American Dual Language Learners in Head Start

#### *Xintong Yang* Sponsor: Yuuko Tonkovich, Ed.D.

Education

Research shows that classroom language has a role in children's language development with both monolingual and dual language learners (DLLs), particularly for children from lowsocio-economic homes. The limited past studies that examine classroom language have focused on Spanish-English DLLs. However, DLLs are a heterogeneous group and more research needs to be done with DLLs from other language backgrounds. This study examines (a) the difference between Mexican-American (MA) and Chinese-American (CA), (b) the effect of lead teacher verbal communication on DLLs' language skills, and (c) correlation between the frequency of English language and heritage language (HL) use by lead teachers and DLLs. Classroom language environment was assessed using the Language Interaction Snapshot (LISn) that captures language interactions of a total of 12 MA and 13 CA preschoolers in Head Start settings. Each participant was observed for 5 snapshots for a total of 25 minutes between spring and summer 2019. Each child's oral proficiency was assessed using the Woodcock-Johnson IV Tests of Oral Language. Preliminary results show that teachers with CA DLLs spoke in HL more than teachers with MA DLLs. CA DLLs also talked to their teachers in HL more frequently than MA DLLs. Implications for educators will be discussed.

# Language, Laterality, and Handedness in Autism Spectrum Disorder

Bing Ying (Laura) Yang Sponsor: Christine Nordahl, Ph.D. MED: Psychiatry & Behav Sci

Language is a lateralized function in the human brain, meaning that it is typically localized to one hemisphere over the other. It is also closely linked to hand preference. The majority of typically developing (TD) individuals have leftward lateralized language and are right-handed. In autism spectrum disorder (ASD), a neurodevelopmental condition involving deficits in social communication skills, language impairments are also common. Magnetic resonance imaging (MRI) research has found reversals in laterality of language-related brain regions and higher incidence of left-handedness in individuals with ASD. Due to the close linkage of handedness and language, hand preference is of interest when studying brain lateralization in ASD. This project will analyze handedness and MRI data from the Autism Phenome Project in TD and ASD children at 2-4 years and again at 9-12 years of age. Preliminary results indicate that at the earliest time point, a greater proportion of ASD children (17.2%) were left-handed than TD children (8.4%). Consistency of hand preference at 9-12 years and group differences will be evaluated. This project will also examine laterality of language-related brain regions in this cohort, using handedness as a covariate of interest.

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

Noah Yardeny Sponsor: David Olson, Ph.D. Chemistry

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

# Examining the Stress Response in Biracial, Multiracial, and Monoracial Children

Sydney Yi Sponsor: Camelia Hostinar Caudill, Ph.D. Psychology

Biracial and multiracial individuals experience stressors and advantages unique from their monoracial counterparts. The present study sought to evaluate the association between mixed racial identity and stress response in children. Participants included 172 children ages 9-11 (Mean age = 9.92 years, SD =.58) who completed the Daily Hassles Scale and provided a hair sample to be assayed for cortisol concentration. Parents reported their child's internalizing and externalizing symptoms (HBQ-P). Children were split into five groups based on parentreported child racial identity: biracial (n = 29), minoritymonoracial (n = 20), White-monoracial (n = 94), multiracial (n = 12), and White-Hispanic (n = 17). Preliminary analyses revealed no significant differences between racial groups on reported total daily hassles, internalizing and externalizing symptoms, or hair cortisol levels (ps > .05). This could be due to socioeconomic status, group distribution, or unmeasured moderators. We plan to examine discrepancies between parent and child-reported racial identity, and compare our sample's racial group distribution to Census data. Follow-up analyses may allow us to capture the interaction between mixed racial identity and stress levels. Future research should work to understand the psychological impact of stressors or resilience factors for multiracial-as compared to monoracial-children, which can have implications for intervention.

# *Jillian Yick* Sponsor: Yuuko Tonkovich, Ph.D. Education

Past studies have shown that parents' openness in emotion talk (ET) with their child can facilitate a stronger sense of control in the child's emotion regulation (ER). ET is the use of emotion language (e.g. emotion words, emotion questions) and plays a crucial role in socializing emotion understanding and behaviors. ER encompasses all processes in monitoring, understanding, and modifying one's reactions to the outside environment in an effort to accomplish one's goals. However, there is less research with families of diverse cultural backgrounds. To address the gaps in previous research, this study examines differences in cultural groups and the associations between ET and children's ER with Mexican-American (MA) (N=46) and Chinese-American (CA) (N=44) families from Head Start. Parents were asked to read a picture book, "Frog, Where Are You?" to their child. Children's ER was assessed by the Transparent Box task, a frustration eliciting task. Preliminary results show significant differences in ET between MA and CA parents with MA parents showing more ET than CA parents. Preliminary findings also show associations between parents' negative words and child's persistence during the Transparent Box activity. These results suggest possible cultural differences. Implications will be discussed.

#### Evolutionary and Sequence Analysis of Putative Genes Associated with Nitrogen Use in Wheat

Nancy Yip Sponsor: Diane Beckles, Ph.D. Plant Sciences

Wheat provides 20% of the calories consumed by humans and is grown on almost every continent on earth. Nitrogenous fertilizer is used to promote wheat yield and quality, but it is expensive, and harmful to the environment, contributing to greenhouse gases and eutrophication of natural waterways. Therefore, improving nitrogen use efficiency (NUE), i.e., the proportion of nitrogen taken up from the soil and converted to wheat biomass is important. Through QTL mapping, a region of the wheat genome potentially associated with NUE was discovered. Some of the genes in this region may be related to nitrogen and nutrient uptake; however, they have not been characterized or, have not been studied in wheat. In this work, we will perform a full bioinformatics analysis of three candidate genes in this region. Evolutionary, sequence and protein analyses will be performed using an array of available tools. These data will build a foundation of the important information needed to help prioritize the genes for functional in-lab testing, to determine their potential contribution to NUE in wheat.

# The Role of Infant-Directed Action on Infant Attention: A Comparison of Monolingual and Bilingual Infant-Caregiver Dyads

#### *Melanie Yoon* Sponsor: Katharine Graf Estes, Ph.D. Psychology

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

# Identifying a non-human primate model of optic neuropathy through a spontaneous pathologic mutation in the *OPA1* gene

*Laura Young* Sponsor: Sara Thomasy, D.V.M.,Ph.D. VM: Surg/Rad Science

Autosomal dominant optic atrophy (ADOA) is a heritable condition characterized by optic nerve degeneration in humans. ADOA leads to visual impairment through retinal ganglion cell (RGC) damage. Cell based transplantation and gene therapy hold promise for treating ADOA and other optic neuropathies, but require further development before reaching human clinical trials. The non-human primate (NHP) serves as a model to study novel retinal disease therapies due to their anatomical and physiological similarities to the human retina. We identified a heterozygous A8S mutation in the OPA1 gene in a colony of rhesus macaques at the California National Primate Research Center. The same mutation is found to be responsible for human ADOA. Using pedigree analysis, we identified 24 primates heterozygous for this mutation and confirmed their genotype by whole exome sequencing. Upon ophthalmic examination, these primates presented a phenotype resembling Specifically, heterozygous primates human ADOA. demonstrated a reduced negative photopic response during electroretinography and a decreased retinal nerve fiber layer, both characteristics of RGC malfunction and cell loss. With the genetic and phenotypic similarities between ADOA NHPs and humans, this non-human primate model is an invaluable tool for studying new treatments for optic neuropathies likely to be translatable to the human population.

#### Neuropathology in a Mouse Model of Organophosphate Intoxication

#### *Alexandria Yu* Sponsor: Pamela Lein, Ph.D. VM: Molecular Bio Sciences

Organophosphates (OPs) are a class of synthetic neurotoxic compounds that can cause convulsions, status epilepticus (SE), and death with acute exposure. These compounds include nerve agents, such as sarin and soman, and pesticides, including diisopropylfluorophosphate (DFP). Organophosphates trigger seizures by binding to acetylcholinesterase (AChE), an enzyme that catalyzes the hydrolysis of acetylcholine into choline and acetate, thereby inhibiting the breakdown of acetylcholine in the body. The consequences of these seizures can be long-term neuropathology, cognitive deficits, and acquired epilepsy. Our lab is investigating the neurological effects of OPs by developing a mouse model of DFP intoxication that mimics the neurological consequences seen in human survivors of OP poisoning. After an acute injection of DFP, treated mice experience seizures that progress to SE for at least 4 h. Increased neurodegeneration, reactive astrogliosis, and microgliosis were observed in the brains of DFP-induced mice compared to the vehicle controls. Significant AChE inhibition occurred for at least 14 d in the brains of DFP-treated mice, and for up to 3 d in the blood. With the histological and biochemical findings of this study, mice will be used as a preclinical model to further investigate the mechanisms of DFPinduced neuropathology using genetic knockout strains.

#### Do Barriers to Voting Have Differential Effects on Democrats and Republicans?

#### Lauren Zaren Sponsor: Benjamin Highton, Ph.D. Political Science

There has been a marked increase in restrictive voting policies implemented at the state level since 2008. Most existing research seeks to measure the effects of these policies by analyzing specific barriers to voting. Instead, I rely on a composite index developed by Li et al., the Cost of Voting Index (COVI). I hypothesize that states with a higher cost of voting will have a larger partisan turnout differential than those with a lower cost of voting, with Democratic partisans turning out at lower rates than Republicans. My analysis found no significant correlation between the partisan turnout differential and COVI scores in the 2012 election, and found a weak positive correlation in the 2016 election. Additionally, my analysis found a weak negative correlation between increases in COVI rankings from 2012 to 2016 and an increase in the partisan turnout differential from 2012 to 2016. The results of this study have implications for future electoral policy decisions.

# The Influence of Classroom Language Environment on Bilingual Language Proficiency: Mexican-American and Chinese-American Dual Language Learners in Head Start

#### *Sunny Zhou* Sponsor: Yuuko Tonkovich, Ed.D. Education

Research shows that classroom language has a role in children's language development with both monolingual and dual language learners (DLLs), particularly for children from lowsocio-economic homes. The limited past studies that examine classroom language have focused on Spanish-English DLLs. However, DLLs are a heterogeneous group and more research needs to be done with DLLs from other language backgrounds. This study examines (a) the difference between Mexican-American (MA) and Chinese-American (CA), (b) the effect of lead teacher verbal communication on DLLs' language skills, and (c) correlation between the frequency of English language and heritage language (HL) use by lead teachers and DLLs. Classroom language environment was assessed using the Language Interaction Snapshot (LISn) that captures language interactions of a total of 12 MA and 13 CA preschoolers in Head Start settings. Each participant was observed for 5 snapshots for a total of 25 minutes between spring and summer 2019. Each child's oral proficiency was assessed using the Woodcock-Johnson IV Tests of Oral Language. Preliminary results show that teachers with CA DLLs spoke in HL more than teachers with MA DLLs. CA DLLs also talked to their teachers in HL more frequently than MA DLLs. Implications for educators will be discussed.

# Activity Budgets of Golden-Mantled Ground Squirrels in the Rocky Mountains

**Dylan Zuver** Sponsor: Dirk Van Vuren, Ph.D. Wildlife & Fisheries Biology

Activity budgets reflect how an organism allocates its time over a day. Time allocation can have fitness consequences and might be influenced by a variety of factors. I will quantify activity budgets of golden-mantled ground squirrels at the Rocky Mountain Biological Laboratory to identify factors influencing time allocation, including the effect of predation risk on time spent vigilant, the effect of presence of conspecifics on time spent alert, and the effect of food availability on time spent foraging. I will collect my own data in the field, recording time spent foraging, alert, vigilant, running, grooming, and interacting, and I will also use existing data from a long-term dataset. To ensure data validity, only subjects that have been observed for 30 days with a minimum of 100 observations per subject will be used. To record my own observations, I will capture and mark squirrels with ear tags for permanent identification, and with unique dye marks on their fur for visual identification. I will conduct one-minute scan-sample observations to note what activity that squirrels in-view are participating in at time of recording. This research is the first of its kind for golden-mantled ground squirrels and will further our understanding of squirrel behavior.