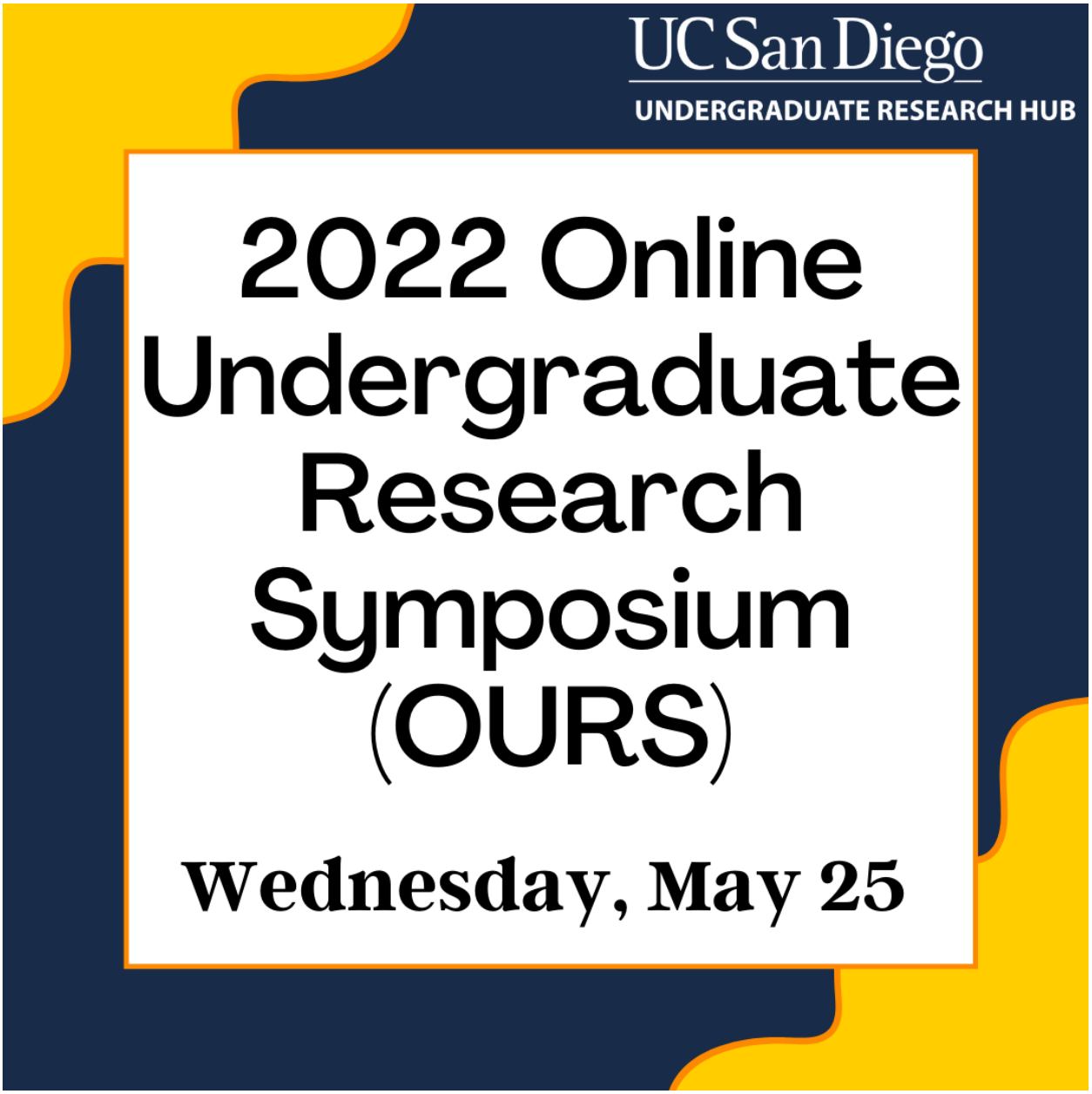


2022 OURS Program

Table of Contents

Conference Schedule

Monday, May 23 – Sunday, June 5

Presentations and posters on display at https://symposium.foragerone.com/2022-online-undergraduate-research-symposium-ours

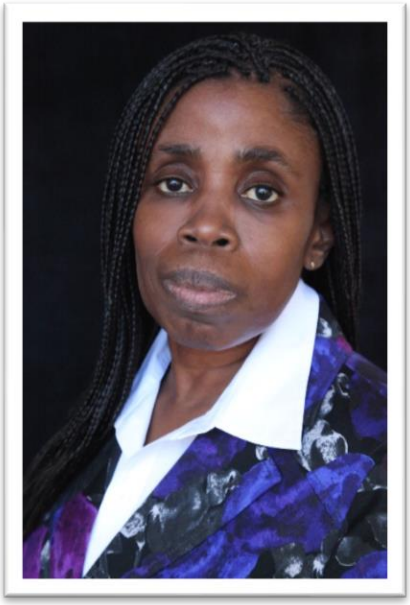
Wednesday, May 25th

5:30 PM - 6:30 PM	OURS Opening Remarks and Outstanding Mentor Awards Ceremony

Live Session Zoom Registration Link

Zoom Rooms	Registration Link
OURS Opening Remarks and Outstanding Mentor Awards Ceremony	https://ucsd.zoom.us/meeting/register/tJcvd-6rrD8oE9JIaoBP-Q-OQrMzoCZyQkaW

Outstanding Mentor Spotlights



Dr. Boatema Boateng

Please tell us a bit about your educational background and current research

I received my Ph.D. in Communications at the Institute of Communications Research at the University of Illinois at Urbana-Champaign. I also hold an M.A. in Mass Communications from the Centre for Mass Communications Research at the University of Leicester, England. I currently have two main research areas: race, gender and authorship; and Black indigeneities.

Did you do research as an undergraduate student? How did you get started in your current field?

My undergraduate training was as a graphic designer and illustrator and did not involve much research. I developed an interest in my current field during my first job after college, and got my start as I pursued advanced degrees in Communication, each of which required me to undertake an original research project.

Who are some of your most memorable mentors? How did you meet them?

One of my most memorable mentors was Dr. Jean Allman, former Professor of History at the University of Illinois at Urbana Champaign, and former President of the African Studies Association. She supported my work and helped me find my voice as a scholar while I was still in graduate school. She continued to mentor me well into my career at UCSD. Another was Dr. T.B. Wereko, former Director-General of the Ghana Institute of Management and Public Administration. We only met twice but something he said at our second meeting changed the course of my life.

Why do you enjoy being a mentor?

At its best, mentoring is like a journey of discovery in which I travel alongside students. Through the conversations we have around their work, I help them develop their skills and guide them toward their goals. Most importantly, I help them discover the brilliance that lies within them. One of my greatest joys as a mentor comes from witnessing the transformation as students go from struggle to mastery of their subject and their craft.

What is the most useful piece of advice a mentor gave you?

“Sometimes a window of opportunity opens up in your life and if you don’t use it, it may close forever.” Dr. Wereko said something along those lines at our second and last meeting when I informed him that I wanted to turn down a lucrative job offer from his institute because I was thinking of getting a Ph.D. His words emboldened me to walk away from what seemed like a dream job and begin the process of applying to graduate schools – a process that led to my Ph.D. and, eventually, to my career at UCSD.

Dr. Michel Estefan

Please tell us a bit about your educational background and current research

I was born and raised in Mexico. I received my undergraduate degree from Universidad Iberoamericana in Mexico City, an institution that had a strong commitment to social justice, particularly as it pertained to Mexico's poor and to its indigenous population. These values have played a central role in my educational trajectory and inform my research and teaching to this day. Most of my time and energy these days is devoted to developing research and teaching practices concerned with the educational success of first-generation, low-income, transfer, and/or racially minoritized students.

Did you do research as an undergraduate student? How did you get started in your current field?

I did not do research as an undergraduate student, but wish I had. And I encourage all my undergraduate students to get involved with research as early as their first year at UCSD. My research trajectory had to wait until graduate school, in a Master's in Latin American Studies I studied at UC Berkeley. I took graduate courses in history, social theory, and pedagogy and had kind and encouraging professors in all three fields that guided me through my first experience collecting original data. It became immediately clear to me early in the project that there's no better way of developing your critical thinking skills and understanding how knowledge is produced than to have first-hand experience with the messy, on the ground process that empirical research entails. I believe having some experience with research is valuable even for students who may not be considering research as their career path.

Who are some of your most memorable mentors? How did you meet them?

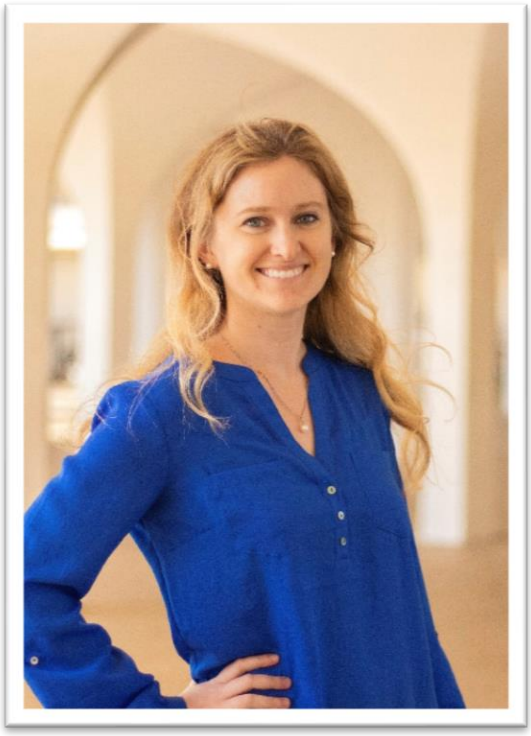
I feel grateful to say there are many, but the first four that come to mind are Victoria Bonnell, Margaret Chowning, Dylan Riley, and Cristina Mora. I met them all at UC Berkeley and each one played a central role in my intellectual trajectory. Victoria and Dylan taught me the importance of expressing confidence in your students, they modeled how to criticize other researchers' work in way that is rigorous, fair and constructive, and they taught me how to think about history in a way that is productively informed by social theory. Margaret and Cristina taught me that fostering a students' intellectual growth is best accomplished when you also support their well-being as an individual. The two go hand-in-hand.

Why do you enjoy being a mentor?

Mentoring allows me to engage students holistically in a way that is unencumbered by things like grades. It’s a space in which learning can be nurtured in a profoundly meaningful way, driven by a sense of camaraderie, empathy, and care.

What is the most useful piece of advice a mentor gave you?

To make sure that my research focused on topics I cared about. Empirical research tends to have relatively long timelines with many ups and downs along the way. What gets you through the challenging moments are your passion and interest in the topics.



Dr. Alexis Komor

Please tell us a bit about your educational background and current research

I received my B.S. in Chemistry from UC Berkeley. I then went to Caltech for my PhD and pursued research with Jacqueline K Barton where I designed and synthesized inorganic molecules that would site-specifically bind to mismatched in DNA. I then did a postdoctoral fellowship at the Broad Institute with David Liu where I developed base editing, a new approach to genome editing that enables the direct, irreversible chemical conversion of one target DNA base into another in a programmable manner, without requiring double-stranded DNA backbone cleavage. My current lab at UCSD develops new precision genome editing methodologies, mechanistically studies how these tools work (from both enzymatic and cellular DNA repair perspectives) and applies these tools to functionally interrogate how specific point mutations contribute to human disease.

Did you do research as an undergraduate student? How did you get started in your current field?

Yes, I pursued research as an undergraduate. I designed and synthesized biomimetic inorganic molecules to catalyze water splitting. I was more interested in biologically oriented research though, so when I went to graduate school I took the opportunity to switch fields into chemical biology.

Who are some of your most memorable mentors? How did you meet them?

My PhD advisor is one of my most memorable mentors; there are not that many female chemistry professors, so being able to look up to her and see that it can be done was very reassuring. She also showed that it was possible to have work-life balance, as she had a family and would take time to pursue hobbies and enjoy life.

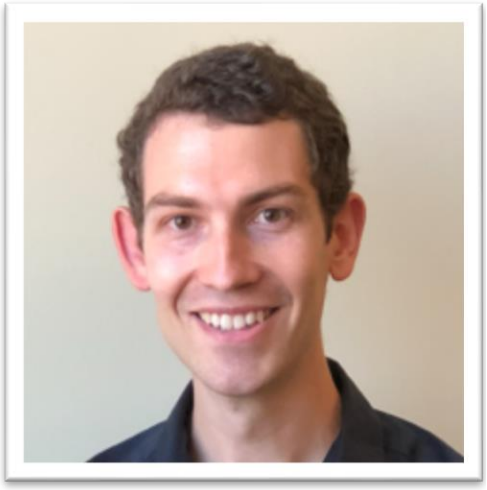
Why do you enjoy being a mentor?

I enjoy training the next generation of scientists. When I mentor undergraduates and graduate students, they are in their very early stages of learning how to design experiments, think critically, and come up with hypotheses. I really enjoy giving advice and seeing them grow and mature into scientists.

What is the most useful piece of advice a mentor gave you?

Mental health is important! You can't do good science if you are overly stressed, too tired, or distracted.

Dr. Johannes Shoeneberg



Abstracts

Hira Ali

Biological Sciences, TRELS
Mentored by Dr. Mark Tuszynski and Dr. Michael Castle

Creating A Drug-Activatable Neurotrophin Receptor for Controlled Gene Therapy

The goal is to create a drug-activatable neurotrophin receptor for more controlled gene therapy. Brain-derived neurotrophic factor (BDNF) is a growth factor that has been shown to have positive effects in Alzheimer's disease in animal models as a form of gene therapy. However, off-target expression may cause hyperactivity and side effects. A method for more controlled and specific activation would provide a safer and more targeted form of therapy.

The enzyme, luciferase, emits light in the presence of its substrate, coelenterazine (CTZ). Neurotrophin receptors have been developed that are activatable by light. The proposed construct conjugates luciferase to the receptor. To summarize, the project focuses on activating a light-activatable neurotrophic receptor, using bioluminescence through administration of coelenterazine.

When the cells containing the receptor were left untreated, there were no neurite extensions observed, When the cells were treated with NGF (another growth factor) neurite extensions were observed. The PC-12 cell line normally has the TrkA receptor that is activated by NGF. When treated with BDNF, neurite extensions are observed. When the cells were treated with 15 minutes of ambient blue light, neurite extensions were seen again. Lastly, after 15 minutes of CTZ administration, neurite extensions are also observed.

Currently, obtaining quantitative data through the GAIN algorithm that was developed by another lab is being optimized. The western blot analysis procedure is also being optimized to confirm whether the specific pathway is being activated. If the construct is successful in these aspects, future research would examine the efficacy in animal models.

Mohnish Alishala

Human Biology, FMP
Mentored by Dr. Christopher Glass and Dr. Thomas Prohaska

Use of CRISPR/Cas9 gene editing methods to investigate the mechanism of Trem2-dependent gene expression in macrophages

Macrophages play a major role in the immune system. They not only provide protection against foreign entities but also assist other immune cells in the healing process. Triggering Receptor Expressed on Myeloid Cells 2 (TREM2) is a surface receptor expressed in macrophages during tissue injury (Gratuze et al., 2018). This receptor plays a role in driving phagocytosis and dampening inflammation. Because of this, they play a large part in diseases such as Alzheimer's disease, nonalcoholic steatohepatitis, and metabolic syndrome. However, the exact pathway in which TREM2 is involved in these diseases is rather unknown (Xiong et al., 2019). Macrophage

gene expression is regulated by a variety of transcription factors such as ATF3 and TFEB. These transcription factors have been suggested to be involved in some of the disease processes mentioned above by RNA-seq or ChIP-seq experiments (Seidmann et al., Troutman et al.).

The research question I will address is how these two transcription factors directly affect transcription in macrophages, specifically in the TREM2 pathway. CRISPR/Cas9 gene editing will be used to generate loss of function alleles for each transcription factor. FACS sorting will be used to isolate single cells, allowing identification of cells with homozygous mutations resulting in complete loss of function. RNA-seq will then be used to compare gene expression to define the gene-specific transcriptional roles of each factor and determine whether they play roles downstream of TREM2 signaling.

Harneet Arora

Human Biology, TRELS
Mentored by Mana Parast

Derivation and analysis of decidualized endometrial stromal fibroblasts from human pluripotent stem cells

Unlike most animal models, the human endometrium undergoes a cyclic process called decidualization to facilitate implantation and subsequent pregnancy. Endometrial stromal fibroblasts (ESF) make up a large proportion of the cells of the human endometrium and their differentiation to decidualized ESF (dESF) is essential for a successful pregnancy. Trophoblast derived from induced pluripotent stem cells (iPSC) of healthy patients and patients diagnosed with preeclampsia, have been used to model the disease phenotype in a dish. With this in mind, we plan to study dESF in the context of disease by similarly deriving dESF from iPSC reprogrammed from patients with term and preterm pregnancies to identify phenotypes associated with disease in dESF. The overall goal of this project is to understand the role that dESF plays in interactions at the maternal-fetal interface. Here we show that we have successfully replicated the differentiation of an embryonic stem cell line to dESF, as measured by qPCR and flow cytometry. Next we plan to apply this protocol to iPSC derived from term and preterm pregnancies to be able to compare iPSC-dESF from term and preterm pregnancies. Eventually, we would like to co-culture iPSC derived dESF with iPSC derived extravillous trophoblast to study the maternal-placental interactions that occur in healthy and diseased pregnancies.

Juancarlos Cancilla

General Biology, TRELS
Mentored by Pam Taub

The Impact of Time Restricted Eating on Patients with Metabolic Syndrome

Circadian rhythms are known to affect the endocrine system, the autonomic nervous system, nutrient absorption, and metabolism. Eating for a long interval of time can negatively impact the body's natural biological clock, and lead to impaired cardiovascular biomarkers. Time-restricted

eating refers to restricting the number of hours in which food is consumed. Taub Research Group is interested in the connection between the reduction of eating timeframes and its impact on circadian rhythms, glucose homeostasis, body composition, and mitochondrial function. The hypothesis is that restricting the time one eats each day will reset their circadian rhythm, and improve overall metabolism and cardiovascular biomarkers.To participate in this study, participants must meet some age and weight requirements and be diagnosed with metabolic syndrome. We screen patients for glucose levels above 100, glycated hemoglobin levels above 5.7, HDL cholesterol levels below 40, and triglycerides above 150.Though we cannot release official data yet, we can conclude that all patients examined have been diagnosed with metabolic syndrome. Data also suggests that there is some improvement in the efficiency of complex I and complex II of the electron transport chain, though more data is needed to confirm these findings.

Valeria Castro Abril

Literature/Writing, McNair
Mentored by Dr. Ariana Ruiz

Epicenter of Exception: Daily Student Crossers at the U.S.-Mexico Border

An analysis of transborder students who cross daily through the San Ysidro Pedestrian Port of Entry to attain their education. I assess how this constitutional-free zone functions as an epicenter where State meets subject and ritualized violence unfolds.

Cheng Chang

Cognitive Science / Department of Cognitive Science, TRELS
Mentored by Vikash Gilja (Professor), Aashish Patel (PhD student)

A Baseline Affect Classification Task with EEG Data

Prediction of users' emotional responses when utilizing computer systems is an important topic in the field of human-computer interaction. In this study, we used the Mahnob-HCI dataset to explore a saliency-aware feature extraction pipeline of EEG data for affect classification. We hypothesize that, by focusing on the EEG recordings within specific time frames when the user is attentive to the "salient" part of the video, we may compress the feature array while improving the prediction accuracy by de-noising the EEG data. My work focuses on creating a data processing pipeline that transforms the EEG data to feature arrays without considering gaze and saliency. Using average channel power from the Alpha, Beta, and Theta band, I created a preprocessing pipeline that transforms EEG data into a feature array. During this process, by randomly omitting different percentages of temporal segments from the feature array, I generated the baseline classification results using linear discriminant analysis (LDA). This baseline can then be compared to results of saliency-aware EEG segmentation informed by pupillometry. For the next step, we want to evaluate different feature extraction and salient event extraction strategies for efficient affect detection.

Vicky Chen

Biochemistry, TRELS
Mentored by Yuko Sugiyama

Increasing Expression of ATP Synthases Through YEF3 Depletion by Auxin-Inducible Degron System

Mitochondria are cellular organelles essential for generating ATP for the cell primarily through oxidative phosphorylation. We have found that decreased translation elongation rate is an important factor impacting the localization of nuclear-encoded mitochondrial mRNAs in Saccharomyces cerevisiae. Previous studies have found that addition of cycloheximide (CHX), a drug that inhibits translational elongation, has led to increased localization of ATP synthase mRNAs during fermentative growth conditions, classifying them as conditionally localized to the mitochondria. My project attempts to inhibit translation elongation by tagging an auxin-induced degron (AID) system to deplete the YEF3 protein, an ATPase involved in translation elongation. The depletion of this gene should globally inhibit translational elongation, similar to CHX. To do this, a plasmid expressing TIR1, which helps recruit ubiquitin for protein degradation, is transformed into yeast. The AID tag is then transformed into the yeast strain containing TIR1, and the AID tag then fuses to YEF3 by homologous recombination. Using methods of microscopy, a translation elongation reporter, and respiration measurements, we will study the effects of the depletion of YEF3 on mRNA localization and translational elongation rates of ATP synthase genes as well as respiration of the cell. Overall, we want to see if a low-level global reduction in the translation elongation of these mRNAs can alter the composition of the mitochondria and change the metabolic state of the cell

Sarah Chittle

Bioengineering, FMP
Mentored by Dr. Yingxiao Wang

Development of High-Performance, Ultrasensitive Single Fluorescent Protein Biosensor for the ZAP70 Kinase

Creating a single fluorescent protein (FP)-based biosensor for the ZAP70 kinase is the goal of this project. Protein kinases are the main regulators of T cell function and understanding these regulators can allow us to learn more about T cell mechanisms. These protein kinases can be studied using FP-based kinase biosensors. One of the most important protein kinases in the T cell is ZAP70. There already exists a Fluorescence Resonance Energy Transfer (FRET) biosensor for ZAP70 but since it requires two emission wavelengths and two excitation wavelengths, it is difficult to use multiple biosensors (multiplex imaging) because the wavelengths cannot overlap. A single FP biosensor alleviates this difficulty. In addition, a single FP-based biosensor can be used to study the differences between chimeric antigen receptor (CAR)-T cells and regular T cell. CAR-T cells are a revolutionary therapeutic cancer treatments and studying the differences in mechanisms between CAR-T cells and regular T cells can reveal opportunities for therapeutic manipulation. This is one of the many applications of a single FP-based biosensor for the ZAP70 kinase.

Jesse de Alva

Electrical Engineering / Electrical and Computer Engineering, McNair
Mentored by Dr. Nicholas Gravish and Curtis Sparks

Designing an Isoperimetric Tape Spring Crawler for Traversal of Granular Media and Constrained Spaces

Traversal through both granular media and constrained spaces both require locomotive designs that can adapt to their surroundings. Therefore, these designs typically end up quite complex in both design and function. Our approach is to keep our design mechanically simple and utilize the soft-robotics and anisotropic behavior of a tape spring to create a crawler capable of inherently adapting to the environment. In the past, the Gravish lab has successfully used soft robotics to traverse granular media. However, in our new approach, we aim to simplify the mechanical design by using only a single degree of freedom for our locomotive. We also aim to showcase the unique properties the tape spring can offer in the field of soft robotics. First, we explore the unique anisotropic behaviors presented by the tape spring. The tape spring offers unique applications due to its high strength to weight ratio and ability to create "kinks" that can move easily throughout the tape once formed. These characteristics will allow us to create a mechanically simple locomotive capable of inherently adapting to its environment.

Allison Delehoy

Biology, FMP
Mentored by Bryan Sun

The Role of Long Non-Coding RNAs in Psoriasis

Psoriasis is a skin condition characterized by skin thickening, inflammation, and dysfunction in the epidermal skin barrier. Long non-coding RNAs (lncRNAs) are found within the non-coding region of the genome, and their role in diseases is not yet fully understood. As seen in preliminary studies and screenings, lncRNAs could possibly have biological functions within psoriasis. Our laboratory identified FLG-AS1 as a new lncRNA linked to psoriasis. FLG-AS1 was found to be a positive regulator of early keratinocyte differentiation; a knockdown of FLG-AS1 impeded the differentiation process, which was evident in the downregulation of known keratinocyte differentiation markers. In this study, FLG-AS1 is overexpressed in keratinocytes, and the expression of the same differentiation markers will be measured in order to see if the results uphold FLG-AS1 as a positive regulator of early keratinocyte differentiation.

Gurman Dhaliwal

Data Science, TRELS
Mentored by David Arnold

Mitigating Maternal Mortality with Doulas

Maternal mortality has been steadily declining worldwide, with one significant outlier: the United States. It is only 1 out of the 8 countries that has seen an increase. Particularly, women

of color are at a greater risk for preterm deliveries, smaller babies, preeclampsia, and high blood pressure and 3-4 times more likely to die for pregnancy-related reasons than white women. During a woman's pregnancy, a doula (trained professional who provides continuous physical, emotional, and informational support to a mother) can mitigate these disparities and contribute to lower healthcare costs.

Recognizing doulas' benefits, Minnesota and Oregon began providing Medicaid coverage for doulas in 2014. Since then, 19 states have at least proposed similar actions. However, according to the Center for American Progress, some community-based doulas believe the credentialing, training, and registration requirements under such legislation may serve to exclude doulas of color and low-income doulas, hence weakening community-based programs targeting low-income areas of colored women through "peer" doulas. Peer doulas are doulas who share a background with their patients.

This project seeks to answer the question if whether the legislation that provides Medicaid reimbursements for doulas poses additional barriers for doulas from underserved backgrounds?

Melanie Dratva

Cognitive Behavioral Neuroscience/ Psychology, TRELS
Mentored by Leslie Carver

Infant sensitivity toward the timing of expected sounds from dynamic visual objects

Everyday experiences include moving objects that generate expected sounds. In neurotypical adults, processing expected sounds generated by dynamic objects, like a bouncing ball, results in early auditory neural responses. To explore the developmental origins of these predictive abilities, we asked whether 4 to 5-month-old infants are sensitive to the temporal synchrony of sounds generated by a dynamic object. This pilot measured the looking time of 5 infants virtually, via their caregiver's local webcam. Our paradigm included a continuous stream of eight trials from three audio-visual (AV) conditions: AV-synchronous, AV-asynchronous, and AV-surprise. We hypothesized that infants would look longer toward the AV-asynchronous condition than the AV-synchronous one. The video recordings were behaviorally coded to obtain infant looking time for each trial, which could be up to 25 seconds or the summed total duration that the infant looked at the display until their first 2-second look away. We then averaged logged looking times across the three conditions for each participant. In our final pilot sample of 4 infants (M_{age}= 4.6 months), the average logged looking time trends towards our prediction, where the infants looked longer toward the AV-asynchronous ($M_{log(10)}$=.94 s) compared to the AV-synchronous condition ($M_{log(10)}$=.85 s). This small pilot sample may suggest early sensitivity to the timing of sounds generated by a moving visual object. Currently, we're increasing the sample size and using a procedure involving infant-controlled trial length to draw more meaningful conclusions regarding these preliminary results.

Brienneth Durazo

Education Studies, McNair
Mentored by Amy Bintliff

Reframing School Detention: A Trauma-Informed Approach

K-12 institutions use traditional approaches to discipline that often entail punitive and ineffective disciplinary actions. A common approach to discipline is often after-school/lunch detention in which students are required to sit quietly for a designated period of time, often unable to talk or work on any school assignments. The purpose of detention is to make students reflect on their behavior and prevent further misbehavior; however, this form of discipline is ineffective and can have adverse effects. In order to maximize learning and promote a safe environment, it is imperative to implement a trauma-informed approach to disciplinary actions in school settings.

Kieran Elrod

Structural Engineering, FMP
Mentored by Tenio Popmintchev

Generation of Attosecond X-ray Laser Beams and Detection Apparatus

Optimizations in the efficiency of the optical system of High Harmonic Generation (HHG) used to create high energy attosecond x-rays will be explored. HHG is the process of utilizing isolated gases in order to generate particular photon emissions that are integer multiples of the “input” laser’s photon energy.

Christian Flores

Cognitive Science, McNair
Mentored by Sean Kross

Artificial Intelligence: Reevaluating Public Perception and Governance

The exponential growth of the technology has left public awareness in the dust. The scholarly attention in this area of research remains negligible. A report made by researchers at Cambridge and Oxford (Brundage et al., 2018) enumerates priority research areas for AI development, one of them highlighting the importance behind balancing optimism about the vast potential of AI technology with a level-headed recognition of the risks involved. In an effort to fill a knowledge gap, this project outlines an agenda for transforming the public perception of artificial intelligence and operationalizing its governance. It encourages a reassessment of beliefs and attitudes surrounding the existing state of AI. More importantly, the project aims to culminate with actionable steps towards reaching ideal AI governance in settings where the technology poses ethical threats. With these outcomes combined, we hope to enable practitioners and lobbyists to make concerted efforts toward mitigating harm caused by AI while promoting rational optimism in vulnerable populations.

Max Gruber

Neurobiology, FMP
Mentored by Dr. Christopher Coyne

Pulmonary Embolism and Cancer: Evaluating the PERC Rule and Predicting 30-Day Mortality

Pulmonary embolism (PE) is a controversial topic that remains one of the most common causes of morbidity and mortality among patients with cancer. To date, there are no validated PE risk stratification tools that take a more nuanced look at cancer. The Pulmonary Embolism Rule-out Criteria (PERC score) is an accepted decision rule for use in the emergency department (ED) on low-risk patients. Our objectives were to 1.) evaluate the performance of the PERC rule when applied retrospectively to ED patients ultimately diagnosed with PE and 2.) evaluate clinical and historical factors among cancer patients with PE, to better understand the risk of 30-day mortality.

Among our cohort of 202 patients, only 7 patients were considered low risk and were PERC negative (96.5% sensitivity). For mortality, on multivariable regression, after adjusting for age and sex, performance status (p=.017) and hospitalization within 30 days (p=.002) remained significant. Cancer type was not found to be a significant factor.

Our results suggest that the PERC score remains highly sensitive, even in a population of cancer patients considered at increased risk for PE. Further, prospective studies are needed to evaluate whether the PERC rule may be safely used to screen for PE in patients with cancer.

Only 2 factors remained significant in terms of 30-day mortality (performance status and recent hospitalization), both of which perhaps underline the importance of patient mobility in the generation of venous thromboembolism, as well as subsequent mobility/mortality.

Gene Heckerman

Psychology, FMP
Mentored by Michael Gorman

The Effects of Dim Lighting on Wheel Running Activity in Mice

Circadian rhythms are intrinsically connected to all functions within the body. Endogenous clock systems determine what processes should occur at which times to preserve health and optimal performance in different animals including humans. There has been enough prior research to show that practical insight can be gained from other animal models that should similarly translate to humans. These systems govern our immune responses, blood pressure, pain sensitivity, and alertness. In a natural setting, our clocks are tuned by sunlight to keep us in sync with the daytime and evening phases. However, in modern times, people have attempted to alter the functions of these endogenous clocks to stretch them beyond their natural means. There is greater awareness related to regulation in a natural environment tuned by sunlight, but far less is known about the effects of moonlight or dim lighting conditions. Unfortunately, dim light has been largely ignored and given less consideration in this circumstance, but they are two sides of the same coin. We are seeing that even a few seconds of blue light from looking at a cell

phone at night can significantly impact the function of our internal clocks. Our primary goal in this research is to manipulate the duration of dim light received to determine how this might impact activity levels. Early data collection has shown results adding supporting evidence that dim lighting is having a statistically significant effect on levels of wheel running activity.

Bryce Henroid

Bioengineering: Bioinformatics, FMP
Mentored by Dr. Alice Chen

Uncovering the Relationship Between Peripheral Arterial Disease and Sepsis

Sepsis is the body's extreme reaction to an infection. In 2017, there were 48.90 million cases of sepsis and 11 million deaths worldwide. Over 200 million people in the world have peripheral arterial disease (PAD).To better understand risk factors that lead to sepsis, this review investigated the role of PAD in patients who develop sepsis. Research shows that endothelial function of blood vessels is impaired in both sepsis and peripheral arterial disease. Our hypothesis is that patients with peripheral arterial disease have worse outcomes in sepsis because of pre-existing dysfunction in their microcirculation.

Tianrui Huang

Philosophy, TRELS
Mentored by Jennifer Carr

What Makes Good Communication?

This presentation discusses good communication, especially its necessary conditions. I'll try to deconstruct these conditions and categorize good communication into four different dimensions. Then I'll argue that, even with the absence of universally-established evaluation criteria, it doesn't mean that a conversation cannot be assessed.

Kriti Iyer

Human Biology, FMP
Mentored by William Kim

Effects of Drug Synergy on EMT-induced Drug Resistance in HCC1806 Cells

Breast cancers are composed of different types of cancer cells, with several subtypes distinguished by certain molecular features/hallmarks. The Epithelial-Mesenchymal Transition (EMT) phenotype is a series of molecular changes that cause cells to lose epithelial morphology and function, and gain mesenychmal-like features, such as increased migratory ability. EMT is thought to play a significant role in conferring drug resistance in triple negative breast cancers (TNBC), making it important to investigate and treat EMT-induced drug resistance. EMT is regulated by several transcription factors (TFs), including ZEB1. We generated lentivirus from a construct that uses the ZEB1 3' UTR to drive GFP expression. We are infecting a TNBC epithelial cell line HCC1806 with the lentivirus to allow for reporting on ZEB1 function in these cells. We

then plan to treat HCC1806 with several chemotherapy drugs. Using the ZEB1 reporter to detect and characterize any nascent EMT in HCC1806, we aim to determine if EMT induction is a mechanism of drug resistance in HCC1806. We will then treat the HCC1806 cells with AZD4547 and Dasatinib, a drug combination that our group has shown to be synergistic against EMT cell lines, to determine if EMT induction as a drug resistance mechanism in HCC1806 can be treated with this drug combination.

Shengqiu Jin

Computer Engineering, FMP
Mentored by Paul H. Siegel

Statistical and Generative Model of TLC Flash Memory Read Voltage

Mathematical models that realistically simulate the behavior of flash memory read voltages are essential tools in the design of signal processing and coding algorithms that improve memory performance. The goal of this project is to develop a neural network based generative model that captures the complex spatial and temporal characteristics of flash memory read voltages. Of particular interest are the spatial dependence of a cell's voltage on the program voltage of its neighboring cells in the array and the temporal dependence on the number of program/erase (PE) cycles and the retention time (i.e., the elapsed time since the cell was programmed). The dependence on PE cycle count has been considered in quasi-analytic models described in prior literature. These models extend static models of the read voltage distributions at a given PE cycle count (based on Gaussian, Normal-Laplace, and Student-t distributions) by incorporating parameters that reflect the dynamic shifts in the voltages as a function of the number of PE cycles. A related prior work attempts to additionally model the voltage shifts and bit-error-rate as a function of the retention time. We will first apply these previous statistical modeling approaches to a dataset of read voltage measurements taken in our CMRR laboratory from triple-level-cell (TLC) NAND flash memory chips. We will then implement and evaluate a new generative model architecture based on an explicitly controllable Variational Auto-Encoder / Generative Adversarial Network (VAE-GAN).

Brooke Johnson

Global Health, McNair
Mentored by Dr. Fabian Rivera-Chavez

The Lysogenic CTXΦ phage influence on Vibrio cholerae pathogenicity

Cholera is a severe diarrheal disease in humans caused by infection with *Vibrio cholerae*. There are an estimated 1.3-4.0 million cholera cases and 21,000-143,000 deaths worldwide due to cholera per year (Ali et al., 2015). Children are disproportionately at risk as they are 10 times more likely to contract cholera and die of the disease compared to adults. Thus, investigating the molecular mechanisms by which *V. cholerae* causes severe disease may help shed light into novel treatments and preventative therapeutics for the disease. Cholera toxin (CT) is a protein complex produced by *V. cholerae* during infection that is required for *V. cholerae* to cause severe disease (Rivera-Chávez et al., 2019). CT is encoded by genes *ctxA* and *ctxB* and are of

phage origin, specifically the filamentous bacteriophage called CTXΦ (Pant et al., 2019). The CTXΦ phage is integrated within *V. cholerae*, allowing the cholera toxin (CT) genes to be expressed (Pant et al., 2019). However, the CTXΦ phages encoding cholera toxin (CT) present in different *V. cholerae* strains have distinct genome sequences (Pant et al., 2019). How these different genome sequences of CTXΦ phage impact virulence, pathogen growth, and host-microbe interactions during infection remains unknown. Therefore, this research project aims to compare how different sequences of the integrated CTXΦ phage sequences influence the pathogenicity of *V. cholerae*. Such examination will explore how different genome sequences of CT impact pathogenicity and how the other genes of the CTXΦ phage influence the severity of the disease cholera.

Suthanth Kashyapa

Human Biology, FMP
Mentored by Dr. Willis Li

Meta-analysis about 53BP1's recently discovered functions

The realm of cancer research has been ever expanding ever since the advent of modern medicine. Every minute and notable discovery of cellular proteins and their potential in carcinogenesis has been published in countless research journals. This research paper has gone over one of these proteins- 53BP1.

Ishaan Kavoori

Mathematics - Computer Science, FMP
Mentored by Javier Duarte

FAIR4HEP: Data Science Project Template for FAIR AI models

In fields of study that utilize data science, it is important to be able to reuse and share large datasets. Researchers aim to develop data science frameworks that are Findable, Accessible, Interoperable, and Reusable (FAIR) in order to meet their needs. The FAIR4HEP project uses research in high-energy physics (HEP) as the application for which FAIR frameworks are used and developed. The people who work on the FAIR4HEP project maintain a Github repository of a project template for data science called “cookiecutter-data-science”. The purpose of this tool is to make it easy to start a new generic data science project with a project template that will contain everything a project might need. The cookiecutter-data-science repository can be modified to fit the standards and purposes of the people who need to use it. The purpose of my project is to research the ways in which the repository can be modified as well as the various ways to interpret FAIR principles and how they can be incorporated into this data science tool.

Tatiyana Kazlova

Psychology, McNair
Mentored by Dr. Gail Heyman

Gift-giving across the cultures

Gift-giving is an integral part of life and can play an essential role in shaping many different relationships. People often give gifts to strengthen relationships, but the wrong gifts can have the opposite effect. Thus, this presents challenges to gift-givers selecting gifts and gifts-receivers responding to inappropriate gifts or gifts they may not like. The present research examines some of these challenges from a cross-cultural perspective and relationship context.

Anuj Khetarpal

General Biology, TRELS
Mentored by Victor Nizet and Erlinda Ulloa

EDTA as Adjunctive Therapy for Drug Resistant Staphylococcal Infections

Staphylococcal infections are associated with high morbidity and mortality, underscoring the need for novel treatment strategies. Glycopeptide antibiotics such as vancomycin are a therapeutic cornerstone for methicillin-resistant *Staphylococcus aureus* (MRSA) infections, including bacteremia and endocarditis. Vancomycin activity against *S. aureus* is weak compared to beta-lactams clinically. One contributing factor may be its lack of bactericidal cooperativity with components of the host's innate immune system that is often seen with beta-lactams. Nutritional immunity is a component of the innate immune response that restricts essential heavy metals from bacterial pathogens. Therefore, chelation therapy with agents such as ethylenediamenetetraacetic acid (EDTA) have been considered as a viable adjunctive therapy to enhance antibiotic treatment of *S. aureus* infection. Building upon these concepts, this study was undertaken to determine if vancomycin activity against glycopeptide-intermediate *S. aureus* (GISA) could be enhanced with EDTA in a murine sepsis model and, if so, if a specific component of the host immune system was responsible.

Elise Kim

Molecular and Cellular Biology, FMP
Mentored by Robert Rissman

Identifying Biomarkers of Alzheimer's Disease in Down Syndrome-Alzheimer's Disease (DS-AD) Patients

Down Syndrome (DS) is a chromosomal disorder associated with mild to moderate intellectual disability. It is caused by the presence of three copies of the human chromosome 21 (Hsa21) (Zigman 2013). In the DS population, there is a high correlation between Alzheimer's Disease (AD) and cognitive impairment, induced by the triplication of amyloid precursor protein (APP) on Hsa21 (Lee et al., 2017). The overexpression of APP causes amyloid plaques to form and leads to an increased production of amyloid β (Aβ) peptides. Thus, there is an increased formation of toxic plasma Aβ40 and Aβ42 peptide, which are characteristics of AD (Coppus et al., 2011). Since DS patients are genetically predisposed for AD (50% by late 50s and 80% by late 60s) (Zigman et al., 2007, Silverman et al., 2021), developing reliable blood-based biomarkers for the DS-AD population is a necessity.

In recent years, exosomes have emerged as potential biomarkers for AD. Exosomes are extracellular vesicles secreted by most cells in the body and are important players in cell-to-cell communication pathways, carrying information that may expose pathologies. As such, their contributions to the pathological spread of factors that underlie AD and other neuropathological diseases have been observed (Hamlett et al., 2019). In order to quantify AD expression and progression, we will isolate total exosomes from human plasma, and further examine isolated neuron-derived and astrocyte-derived exosomes.

Hannah Kim

Neurobiology, McNair
Mentored by Nicholas Spitzer

Validating an Optogenetic approach to study Neurotransmitter Switching

Neurotransmitter switching (NTS) is a form of neuroplasticity in which a subset of neurons stop expressing the transmitter they were expressing before and start expressing a different one in response to chronic stimuli [1]. Exposure to the drugs of abuse phencyclidine and methamphetamine induces NTS in Prelimbic Cortex of mice [2].

Because exposure to addictive drugs induces phasic firing of Ventral Tegmental Area (VTA) dopaminergic neuron (DA), we now want to test if mimicking VTA DA neuron phasic firing is sufficient to induce NTS in the Prelimbic Cortex. We are therefore validating an approach to optogenetically stimulate VTA DA neurons. To allow optogenetic stimulation of VTA DA neurons, we are using DAT-Cre +/- mice that express Cre recombinase in dopaminergic neurons and we are injecting them in the VTA with a Cre-dependent AAV expressing the yellow fluorescent protein (eYFP) and the light activated protein Channelrhodopsin2 (Chr2) (i.e. AAV-DIO-ChR2-eYFP). Neurons expressing ChR2 can be activated by shining blue light on them through an optic fiber implanted at the midline of the VTA. I will verify that VTA dopaminergic neurons expressing ChR2 are activated by laser stimulation using c-fos immunostaining as a proxy for neuronal activation. The objective of this project is to validate this optogenetic approach to manipulate neuronal activity of the VTA DA neurons.

Rachel Lau

Neurobiology, FMP
Mentored by Gary Vilke

Utility of Magnesium Level Tests in the Emergency Department

Over the past few years, it has become apparent that the overutilization of certain forms of care or treatments can negatively impact patient care. This has been particularly relevant for the emergency department, where electrolyte tests are often used to diagnose patients' ailments. There have been studies that looked into the utilization of three different tests—magnesium, calcium, and phosphorous level tests. However, there has not been much to discuss each one in detail. We hypothesized that magnesium level tests are often overused in UC San Diego affiliated hospitals, as the results of these tests may not end up affecting patient care. We first

conducted a literature review to find past studies as a means of comparing the results we find there to what our study might conclude. Then we conducted a retrospective chart review of magnesium test ordering practices to analyze how the ED manages patients that have abnormal levels of magnesium to determine if it changes their level of care.

Adam Lee

Data Science / Mathematics, TRELS
Mentored by Talmo Pereira, Kay Tye

Refining NeuroEthological Simulation with Machine Learning

Neurological studies in the field of animal behavior are time consuming and expensive – requiring a large amount of domain expertise and lab equipment in order to test hypotheses regarding even a single behavior trait. A promising solution is simulation - enabling researchers to quickly test and generate hypotheses. However, current simulations of animal behavior exhibit unrealistic body movements and utilize behavioral models that lack parallels to real brains. To solve this, we introduce a pipeline for a more realistic neuroethological simulation. We accomplish this by training a behavioral model directly on motion capture data of real animals with machine learning, and enabling a wide variety of neurologically-inspired models to be tested flexibly on top of our framework.

Allison Li

Cellular and Molecular Medicine, TRELS
Mentored by Maya Gosztyla

CIRTS Constructs are Effective in Targeting Microsatellite Repeat Expansion Disorders

CRISPR-Cas-inspired RNA targeting system (CIRTS) engineers programmable RNA effectors from human proteins. Unlike CRISPR Cas13d, this strategy eliminates bacterial proteins, thus not triggering an immune response. This project aims to determine the effectiveness of CIRTS in eliminating RNAs that cause Microsatellite Repeat Expansion disorders (MREs). MREs are DNA mutations that are caused by sequence repetitions within the human genome. These regions of mutated DNA code for harmful RNA which primarily affects the nervous system. We performed transfection, RNA extraction, and RNA dot blots using CIRTS constructs designed to target MRE-containing RNAs. We observed a strong knockdown of CAG repeats and CUG repeats transiently expressed in HEK293T cells. These results demonstrate that CIRTS could possibly be an effective RNA editing technology that could be used to target MRE disorders.

Anni Li

Physics, FMP
Mentored by Javier Duarte

Conditional Generation of High-Energy Particle Collisions with Graph Networks

This project is to explore applications of Auxiliary Classifier Generative Adversarial Networks (ACGAN) in Graph Neural Networks (GNNs) for the conditional generation of jets. We will use an advanced model of GAN, which is the Auxiliary Classifier Generative Adversarial Networks. This helps us to generate conditional jets of specific types or momenta, which is very useful for high-energy physics research at CERN.

The dataset we use is in form of graph neural networks instead of traditional graphs. In our project, GNNs are used to be the graphical representation that describes jets as nodes & edges and combines them as a network, which has Less computational complexity, and high efficiency with more information included.

Samantha Mak

Neurobiology, McNair
Mentored by Nicole Coufal

Role of Microglia in Neurodegenerative Langerhans Cell Histiocytosis

Preliminary studies have indicated that microglia, the innate immune effector cell of the central nervous system (CNS) plays an important role in brain infection and inflammation and could be the primary cause of the neurodegenerative symptoms seen in Langerhans Cell Histiocytosis (LCH). A murine model of LCH has shown that a somatic mosaic BRAF(V600E) mutation in myeloid cells leads to microglial mosaicism that results in mice with a progressive neurodegenerative disorder similar to what is seen in patients. To this end, we are investigating the role of microglia differentiated from LCH patient-derived iPSCs. In cells with characteristics of LCH, about 64% present a mutation in the MAPK pathway known as BRAFV600E. To further investigate, we are utilizing CRISPR technology to introduce this mutation into induced pluripotent stem cells (iPSCs) and differentiating them into induced microglia-like cells (iMGs) in order to engraft them in murine models. We hope that this will allow us to understand the mechanisms of how microglia drive these neurodegenerative symptoms in LCH and in the long term, we hope to be able to provide an in vitro model for studying LCH in humans and derive a treatment for neurodegenerative LCH.

Deisy Martinez

Cognitive and Behavioral Neuroscience B.S/ Cognitive Science Department | Business Psychology B.S/ Psychology Department, McNair
Mentored by Lindsey Powell

Infants' understanding of Ownership Rights

Ownership connects individuals with particular objects and confers various rights to owners. These rights make it unacceptable for people to use or take objects belonging to others without permission. How and when does an understanding of ownership rights develop? Previous research suggests that infants by 12 months of age associate objects with their owners (Saylor et al., 2011). Here we ask whether infants this age can identify objects belonging to others using verbal cues and whether they use ownership to reason about people's emotional reactions to

events involving property. There is an effect of having an older sibling ($p = 0.037$), as infants are more surprised by a positive reaction indicating that they expect owners to respect others' property. Additionally, there appears to be an effect of the condition ($p = 0.203$) where infants look longer at the neutral condition. These findings raise the possibility that Infants that do not have older siblings appear to be developing a different understanding of ownership.

Vidisha Marwaha

Human Biology/ Biological Sciences, FMP
Mentored by Matthew Shtrahman

Adeno-associated virus-induced ablation of neurogenesis

Dentate Gyrus is one of the only few regions of the brain that maintains neurogenesis into adulthood. Adult-born dentate granule cells (abDGCs) are continuously generated from stem cells that undergo proliferation, differentiation, and fate specification before maturing into neurons. Numerous studies have shown that abDGCs are critical for maintaining the physiological activity of mature DGCs and contribute to hippocampus-dependent behaviors.

Wild-type adeno-associated virus (AAV) is a replication-defective, non-enveloped single-stranded DNA parvovirus with no known pathogenicity. It is a distinct virus that requires co-infection from a helper virus to enter the lytic phase. The recombinant adeno-associated virus (rAAV), which retains only part of the original AAV genome, is widely used in experimental neuroscience. Minimal genome and limited immunogenicity have made rAAV the vector of choice for human gene therapy. However, a recent study published in eLife has shown rAAV-induced toxicity in the neurogenesis of the adult mouse hippocampus.

As per the research, it was discovered that the adeno-associated virus kills neural progenitor cells and abDGCs within hours to days. rAAV-induced cell death is rapid and persistent, with nearly complete loss of immature DGCs and causing hyperactivity in mature DGCs. Our project goal is to advance previous research on rAAV toxicity and find if AAV induces the loss of mature DGCs.

Alison McAnally

Physics, McNair
Mentored by Abigail Kopec

Search for Dark Matter in S2 Signals

The poster today shows the x and y positions of S1 and S2 signals over the course of a few hours in XENONnT's time projection chamber.

Jose Mercado

MAE, McNair
Mentored by Ralph Keeling

The Development of an Affordable Microfluidics Controller

The development of an affordable system which can deliver a constant, low-volume flow of seawater into a system utilizing pressurized gas to generate water flow. The ability to control gas flow can ideally be applied to provide a highly controlled, precise method of flow generation and control for water.

Judy Mohamad

MAE, TRELS
Mentored by Sander Tonkens

Safe Autonomous Guidance and Navigation for UAVs

Many autonomous robots rely on a consistent model of their dynamics that assumes only perfect conditions. However, many cannot adapt well to small changes in their physical body or surroundings because they don't account for uncertainties when making decisions. Using the conventional model-based control, an autonomous drone needs to be manually tuned every time its payload changes slightly.

Recent work on autonomous robots has used a combination of a known model and a to-be-learned model; so, before completing its objective, a robot is uncertain about its own physical dynamics and tries to learn them on its own. To the best of our knowledge, there haven't been hardware implementations of this on drones, so in this research project, we will implement tests of this learning algorithm on a drone capable of complex tasks.

In this work, we reduce the uncertainty of the residual dynamics as follows: We maintain a Bayesian uncertainty representation of the unknown dynamics, which is updated based on new observations (measurements) of the environment. An example of this is if an autonomous drone measures data to figure out its new mass upon getting a new payload, then updates its control parameters before taking full flight. Learning these residual dynamics requires no human intervention because the robot learns and changes the model of its dynamics.

Improvements in autonomous drone navigation could help with various real-life applications, such as drone delivery, drone wildfire extinguishing, drones in agriculture, etc.

Carlos Monterosa

Data Science, McNair
Mentored by Amarnath Gupta

Phishing Networks

With smart technology becoming a ubiquitous part of our lives. It has offered new ways of fraud, scamming, and theft to take place. Whether through emails, phone-calls, and text, criminals attempt to gain access to individuals' finances and personal information. Even though the methods vary in their approach they all attempt to victimize innocent and vulnerable people. The main area we would like to focus on is scamming networks that use emails as their primary resource to commit fraud. As of today, 67% of emails being sent are spam, according to internet live stats. Not all spam emails are malignant in nature, but we know that phishing

emails (emails used to extract personal information or install malicious software) operate innocuously as spam emails. Meaning, that there is a high probability that among those spam emails there is in fact a phishing email waiting to attack. Our strategy is to deter potential victims from being preyed upon by email scammers. We aim to do this by bringing awareness and potentially uncovering scamming networks.

Laura Noronha

Human Biology, FMP
Mentored by Jillybeth Burgado and Dr. Nicola Allen

Alzheimer's Disease (AD)-Associated Changes to Astrocytes: Potential Role in Synaptic Deficits?

Glial cells called astrocytes are important for the formation of the blood brain barrier, provide neurons with nutrients, and recycle neurotransmitters. They also play a dynamic role in neuronal synapse formation, maturation, and elimination. Since astrocytic properties change in aging and disease, there is increasing interest in the role of astrocytes in Alzheimer's progression. Alzheimer's Disease (AD) is a progressive neurodegenerative disorder characterized by excess amyloid plaque and tau tangles that contribute to neuronal cell death. The goal of this project is to see how astrocytes contribute to synaptic and neuronal dysfunction. This will be done using human induced pluripotent stem cells (iPSCs). An iPSC line will be derived from healthy, age-matched controls, and neurons will be obtained with an established direct protocol. Astrocytes will be derived from iPSC lines (iPSC-iA) from an age-matched control cohort and subjects diagnosed with late-onset AD. iPSC-induced neurons (iPSC-iN) will then be treated with astrocyte conditioned media (ACM) from control and AD iPSCs for about 7 days. After treatment, iPSC-iN will be analyzed for synapse number using confocal imaging. Microelectrode arrays will be used to analyze synapse function and neuron survival. Astrocytes derived from iPSCs of late-onset AD subjects demonstrated an altered transcriptomic profile from healthy, age matched controls. Astrocytes release inflammatory cytokines (e.g. IL6) and chemokines, which may contribute to neural degeneration. The upregulation of these genes in AD astrocytes in our data may indicate a role of astrocytic TNF signaling in Alzheimer's Disease progression.

Nate Pak

Anthropology, FMP
Mentored by Dredge Byung'chu Kang

The Healing Effects of Homoerotic Media and Boys' Love (BL)

Boy's Love (BL) media, also known as Yaoi media, is a fictional genre that depicts idealized homoerotic relationships between male characters, and these relationships are often portrayed in a sexual manner. It has been increasingly popular among female youth specifically interested in Asian media like anime, manga, or K-pop. The effects of viewing Yaoi and BL most often begin at the beginning of puberty, where it is easier for such content to develop into an addiction where they spend most of their money, time, and energy. Yaoi and BL are notorious because of said teenage consumers who are believed to have a mentally unhealthy obsession with

homoeroticism. My motive is to find the correlation between BL (Boy's Love)/Yaoi readers and their mental health; I want to prove if or if not all BL readers struggle with their mental health. If so, I want to research what other coping mechanisms there could be that are "healthier".

Briana Parker

Literature, McNair
Mentored by Seth Lerer

Crossing Brooklyn Ferry: A Socially Activated Pedagogical Experiment in the Literary Mapping of Poetic Landscapes, Borders, and the Imagination

Walt Whitman's transcendentalist poem, Crossing Brooklyn Ferry (1856), is a canonical piece of literature from his iconic work Leaves of Grass. Exploring the poems literal and metaphorical landscapes offers readers an opportunity to create meaning into the significance of border crossing and identity. Using Literary Mapping, or a diagrammatic representation of geographic metaphors found in literature, I will illustrate the value of analyzing texts dealing with naturalistic landscapes of borders in order to convey to modern readers how they are academic and cultural border crossers. This visual platform will provide insights into developing culturally responsive teaching strategies that will cultivate conversations in classrooms on diversity, democracy, and individuality.

Lisa Phung

Human Developmental Sciences, McNair
Mentored by Professor Amy Bintliff

Responding to Injustice: Can Strategic Implementation Create Social Change?

Critical service-learning engages students in meaningful service with the integration of experience through partnerships from higher education to the campus-community partners with the goals of nurturing university students' social and cultural awareness in hopes of making improvements. The aim of this study is to investigate transformational aspects of critical service-learning in higher education from multiple perspectives looking at the relationships between service-learning and anti-racist, emancipatory educational goals jointly held by UCSD through the Partners at Learning program.

Across many institutions of higher education, service-learning seems to be a popular approach in engaging students with supplemental fieldwork experience that allows them to enhance their understanding of course concepts. Often, there is an initial intention for undergraduate students participating in service-learning to benefit from the immersive experience. However, with more focus placed on how this pedagogy is geared toward undergraduate students in regards to giving them experience, there is frequently an oversight on what community partners can potentially benefit from these interactions when hosting an undergraduate student at their school site.

We will use a participatory qualitative research approach and have two participant groups and they will be UCSD students involved in service-learning courses within the Department of

Education Studies, and community partners who have hosted UCSD service-learning students enrolled in the courses. For our data collection, we will use surveys, interviews, focus groups, student coursework, and participatory workshops involving visual art.

Nina M. Polit Sobrino

Economics, FMP
Mentored by James E. Rauch

The Evolution of Brazilian Conglomerates

In recent years, we have all witnessed the take-off of Brazilian multinationals, with eight of the top ten multinationals listed on both the New York Stock Exchange and the Sao Paulo Stock Exchange. This phenomenon needs to be seen in the context of Brazil's total inward and outward FDI flows, being M&A and greenfield investments quite important ways in which these flows occurred. These events have drawn our attention to analyze the evolution of Brazilian-based conglomerates, starting from the years of their founding. According to the Data that we have, they are not only the biggest firms in Brazil, but also the most successful growers across the years. In that sense, we were triggered to learn whether relatively young conglomerates were following the same path and strategies as these more mature and well-established business groups.

Simon Poon

Physics, FMP
Mentored by Javier Duarte

Machine Learning for Particle Physics

project aims to develop a graph neural network to predict the missing transverse momentum for a particle collision event. We hope to improve the model to surpass existing ML algorithms. A few changes that we looked at was adding edge features, decreasing the number of input particles and adding feature weights.

Kalie Quon-Adams

International Studies, FMP
Mentored by Giordano De Guglielmo

Chronic CBD attenuates the development of alcohol dependence by reducing alcohol-induced neurodegeneration

Alcohol is the most widely abused substance in the United States (SAMHSA 2013). Approved medications for alcohol use disorder (AUD) have limited efficacy and significant side effects (Goldman, Oroszi et al. 2005, Mason and Lehert 2012, Berrettini 2013, Mason, Quello et al. 2013) and are used by < 10% of U.S. patients with AUD (Jonas, Amick et al. 2014).Thus, the development of novel and more effective medications for AUD is a pressing medical need (Litten, Egli et al. 2012). Growing interest has been seen in the therapeutic potential of

compounds that are found in plants of the *Cannabis*genus (Wilkinson, Yarnell et al. 2016). The cannabis plant contains more than 500 constituents and over 100 phytocannabinoids that actively interact with the body's endocannabinoid system. D9-Tetrahydrocannabinol (THC) and cannabidiol (CBD) are the most commonly studied constituents. Unlike THC, CBD is nonpsychoactive, which can be attributed to its function as a negative allosteric modulator of cannabinoid CB1 and CB2 receptors (Mechoulam, Peters et al. 2007, Laprairie, Bagher et al. 2016), and is approved for the treatment of childhood seizures that are related to Dravet Syndrome. A CBD-containing formulation (Sativex®) is currently used to treat spasticity and neuropathic pain in multiple sclerosis (Devinsky, Marsh et al. 2016, Russo, Naro et al. 2016). Given the positive effects of CBD in preclinical studies, various clinical applications have been proposed, including the treatment of AUD and other substance use disorders (SUDs). Alcohol use disorder is characterized by a problematic pattern of alcohol use that leads to significant impairment and distress (Hasin, O'Brien et al. 2013). The three FDA-approved medications for the treatment of AUD (naltrexone, disulfiram, and acamprosate) are effective in only a limited number of patients, and predicting treatment response is difficult (Jonas, Amick et al. 2014). Despite existing therapies, substantial proportions of patients do not have successful outcomes, indicating a clear need to develop novel treatments. The rationale for using CBD as a pharmacotherapy for AUD comes from its anti-inflammatory, antioxidant, and anticonvulsant properties that may counteract some of the consequences of chronic alcohol use, including the alcohol-induced release of proinflammatory cytokines (Neupane, Skulberg et al. 2016) and withdrawal-induced cortical hyperexcitability (Jesse, Brathen et al. 2017)

Ishrak Ramzan

General Biology and Linguistics, FMP
Mentored by Dr. Richard Childers

Exploring Trends in Stroke Code Activation at UC San Diego Health and Nearby Regional Hospitals

Strokes are one of the leading causes of death in the United States, and pose a significant risk of disability for survivors. There is a short window of time in which providers can adequately treat strokes, leading to hospitals to develop stroke code protocols to screen patients for appropriate interventions. While a net benefit to patients, stroke codes are resource intensive, burdening imaging resources and providers alike. Emergency department physicians have anecdotally seen an increase in stroke code activation in recent years. Due to the resource-intensive nature of stroke codes, we examine the incidence of stroke codes over time, and compare them to ED volume change over time to determine if there has indeed been an increase in stroke code incidence.

Jaysen Reindel

Chemistry, TRELS
Mentored by Robert Pomeroy

Purification of Succinic Acid via Diffusion Dialysis

Biodegradable polyurethane plastics derived from living organisms serve as a possible solution to the global plastic waste crisis. In order to create these biobased polymers, the isolation of succinic acid from a cationic solution is necessary. The purification of said solution can be carried out through a process called diffusion dialysis. This project aims to access the viability of the L-05 Diffusion Dialysis instrument purchased by the Pomeroy Group group and produce a pure succinic acid solution from an unpurified acidic solution. The specific species of cyanobacteria being focused on for polymer production is grown in saltwater and thus the main ion to be excluded from the final product is sodium.

Edwin Ruiz

Cognitive Science, McNair
Mentored by Dr. Alysson Muotri

Strategies to analyze networks in brain organoids

Brain Organoids are lab-grown neural tissues created by reprogramming somatic-living cells into human Induced Pluripotent Stem Cells (iPSCs) that are then cultured in a three-dimensional orbital shaker over the course of several months. In its short lifespan ranging from 1 year to eight hundred days, one can use brain organoids to study the organization of neural activity that develops in accordance with stimulation and after. Current challenges in Stem Cell research include proper recording of developing neural signals, due to the nature of the tools in use for the recording. Our experiment attempts to simulate the naturally occurring environment necessary for developing stem cells by recording with a NeuroNexus Probe, which uses state-of-the-art silicon MEMs technology that produces fewer variables to analyze and allows for the natural recording of neural signals. Using the same device to stimulate the brain organoid it is predicted that its self-organizing nature will produce a synchronized response and adjust, accordingly.

Shaila Sarathy

Global Health, TRELS
Mentored by Claire Edington

Mental Health of Rohingyan Refugees

My research focuses on the mental health of the Rohingya refugees. It examines the history of the refugee crisis and provides context on how long this crisis has been going on for as well as how it started. In my research I explore how the Rohingya refugees understand and cope with mental health in their community. I go on to discuss the various mental health issues that are faced by refugees in Bangladesh and the various interventions that have been implemented that focus on relieving mental health. My research indicates that there needs to be a better understanding of how mental health is coped with in the Rohingya culture. I believe that mental health interventions in this community should be based on cultural context and existing community structures. These interventions should focus on using existing community structures and training Rohingya volunteers in the community to assist in these interventions.

Lauren Serrano

Urban Studies and Planning and Scripps Institution of Oceanography, FMP
Mentored by Deirdre Lyons, Maryna Lesoway

Understanding shell development in Crepidula atrasolea

Snails produce a diversity of shells via biomineralization, but the underlying mechanisms of shell formation are not well understood. In gastropods, the shell is composed of hundreds of proteins called Shell Matrix Proteins (SMPs). We have chosen to examine the expression of one such SMP, named CaSMP1, in the slipper snail *Crepidula atrasolea*. We aim to document larval shell gland development in order to ask mechanistic questions surrounding biomineralization in gastropods. To do so, we developed a two part project: first, antibody staining and fluorescent microscopy of cleavage stage embryos and shell gland stage embryos; and second, *in situ* hybridization to investigate CaSMP1 mRNA expression in *C. atrasolea*. Using our fluorescent imagery, we created staging tables of embryonic development during the first 48 hours post-fertilization (cleavage stages), and later starting at 8 days post-fertilization (shell gland stages). With them, we can visualize important morphological changes, such as the thickening of the shell gland during early organogenesis. A detailed look at shell gland development is especially pertinent to our study of CaSMP1. *In situ* hybridization showed that CaSMP1 expression begins in the shell gland between mid-ovoid and early organogenesis stages, and remains in the mantle after the shell has fully formed. This expression is consistent with the results of our staging tables. At present, our staging tables contribute to the growing body of information on biomineralization in *C. atrasolea*. In the future, they will serve as a reference when comparing normal shell phenotypes to perturbed phenotypes produced by CRISPR gene editing.

Thomas Sievert

Physics, FMP
Mentored by Javier Duarte

Quantum Adiabatic ML with Zooming IMproved (QAML-ZIM)

QAML-ZIM is a quantum machine learning (QML) algorithm that categorizes high energy physics (HEP) events amongst a same-particle, different-topology background. In theory, QML utilizes the unique nature of quantum computers to perform faster than classical machine learning. However, in practice it's difficult to prove this quantum advantage, let alone physically implement it on a quantum computer; due mostly to the current, errorful quantum computing (QC) hardware. In this presentation, we examine QAML-ZIM's performance in comparison with its predecessor QAML-Z.

Meenakshi Singhal

Bioengineering: Biosystems, TRELS
Mentored by Dr. Leah Schaffer, PhD

Exploration of Multi-localizing Proteins in Integrated Maps of Cell Structure

Recent work from the Ideker Lab features MuSIC (Multi-Scale Integrated Cell), a computational platform to build hierarchical maps of cell structure. MuSIC serves as a scalable system to discover novel subcellular structures and protein complexes, and how they are organized within a given cell. Because structure and function go hand-in-hand, what we learn about the human proteome through MuSIC hierarchies can provide a systemic understanding of how diseases like cancer begin and develop. With new protein-protein interaction (PPI) network data from the BioPlex Initiative, we are expanding MuSIC to the U2OS osteosarcoma line. I now seek to stratify the U2OS data by creating cell compartment-specific MuSIC maps. Multi-localizing proteins are of interest as they may help the cell coordinate various reactions and pathways, and thus act as metabolic switches. In particular, we can determine the spatial organization of the complexes in which these hub proteins reside, by integrating protein interaction information with gene annotations curated by the Human Protein Atlas. In Python, I first applied the U2OS PPI edges into HiDeF, a community detection algorithm that predicts protein clusters by optimizing distances. The six largest compartment-specific hierarchies were then visualized via Cytoscape. The function and molecular processes associated with protein communities was evaluated via Gene Ontology term enrichment. By mapping compartment-specific glutamine-ammonia ligase (GLUL) protein clusters onto the original U2OS PPI network, the multi-localizing nature of this gene was further characterized. Overall, this approach presents a way to advance the MuSIC pipeline, by considering the dynamic nature of multi-localizing proteins.

Adriana Siordia

Biochemistry/ Chemistry and Biochemistry, McNair
Mentored by Ellen Breen

Determining the spatial distribution of intracellular oxygen in skeletal myofibers through MiniSOG reporters

The maintenance of oxygen (O2) homeostasis is essential for mammalian life. Oxygen is required for various biochemical pathways such as oxidative phosphorylation and the production of high ATP, enzymatic reactions, and the progression of cancer cells among other critical cellular functions. If cells fail to provide O2 to mitochondria it can lead to metabolic instability that manifests as exercise intolerance and can cause many chronic conditions (i.e., chronic heart failure and chronic obstructive disease). It is important to be able to understand the mechanism by which oxygen is made available for cell use. Specifically, for this project, we are interested in the use of skeletal muscles due to the following reasons. 1) Skeletal myofibers have high O2 and energy demands during exercise. 2) Myofibers are very large cells, several mm in length and generally span the length of the entire muscle, and contain several 100s of nuclei around the periphery. 3) Within myofibers, an extensive network of mitochondria is proposed to be electrically connected and mitochondria located in different fiber compartments use unique signaling mechanisms. The goal of this project is to develop a high-resolution method to characterize the oxygen and mitochondria interactions of myofibers through fluorescent Mini Singlet Oxygen Generator (SOG) tags.

Hailey Stanfield

Human Biology, FMP
Mentored by Edward Castillo

Factors Associated with Longer Length of Stay for Patients with Schizophrenia or Related Conditions and Bipolar Disorder

Mental health resources continue to be a challenge for most communities and often patients with acute mental health issues are cared for in Emergency Departments (EDs). These patients often have prolonged ED stays due to a variety of reasons, including agitation requiring treatment, psychiatric consultation delays and availability of community resources when patients need admission. The purpose of this study was to identify factors associated with an increased length of stay among patients with a primary clinical impression of schizophrenia or related conditions and bipolar disorder.

This was a multicenter retrospective study of all patients with a primary clinical impression of schizophrenia or related conditions and bipolar disorder who were treated in one of two EDs between January 1, 2019 and December 31, 2021. One ED is an urban academic hospital, and the other is a suburban quaternary medical center with a combined annual census of approximately 85,000 visits. Patients were identified by primary clinical impression (schizophrenia and related Conditions included ICD-10 codes F20 – F29; bipolar disorder included ICD10 codes F31.X). Additional data queried from the electronic medical record included demographics (age, sex, ethnicity) and other characteristics including expected payor, emergence severity index (ESI), restraint use, agitation medication given, admit status, and suicide ideation noted. Univariate comparisons were performed using a chi-square test. Independent associations were assessed using logistic regression. Odds rations, 95% confidence intervals and p-values are presented.

Kaitlyn Strandberg

Bioengineering, McNair
Mentored by Dr. Robert Sah

Chondrocyte Proliferation Localization with the 5-ethynyl-2'-deoxyuridine (EdU) Assay

Introduction: Osteoarthritis (OA) is a chronic disease with progressive damage that affects articular cartilage. In early OA, its indwelling cells, chondrocytes divide and form clusters near sites of matrix disruption. Cell proliferation can be localized using 5-ethynyl-2'-deoxyuridine (EdU). EdU can be reacted with azide-modified fluorophores, detected with fluorescence microscopy. *Methods:* EdU incorporation was analyzed in chondrocyte cultures. Proliferation was stimulated with fetal bovine serum (FBS), and the culture duration was 2 or 4 days. Cultures were imaged via phase contrast and fluorescence microscopy to quantify cells. (A1) To determine specificity of EdU labeling, one or both of EdU and Alexa594 were omitted. (A2) To induce variable chondrocyte proliferation, FBS concentrations of 1% and 20% were included with 5µM EdU. (A3) To assess EdU-dependence, concentrations of 0, 1, 2, 5, 10µM were used. *Results:* (A1) EdU-labeling of proliferative chondrocytes was specific to the presence of

EdU and Alexa594 ($P<0.005$). (A2) On days 2 and 4, EdU-labeled cultures incubated with 20% FBS had densities trending higher than with 1% FBS. (A3) Phase-contrast cell density varied with EdU concentration and culture duration ($P<0.05$). *Discussion:* A strong fluorescence signal was detected in all concentrations of EdU indicating that EdU is effective at labeling cells. However, the hindrance of cell growth with 1-10µM EdU indicates that it should be used as a terminal assay of proliferating cells, rather than for prolonged cultures. Further studies may assess shorter labeling times and relationship to cell cycling.

Steven Swee

Chemical Engineering, FMP
Mentored by Richard Childers

ED Initiated Buprenorphine Treatment in a Population with High Rate of Homelessness

One of the challenges that US emergency departments face is the influx of patients with ailments related to drug overdose and dependence. In this study, we focus on the California Bridge Program and analyze the effects of emergency department-initiated buprenorphine treatment on a population with a high homelessness population. The main goal is to reduce opioid dependence. It was found that females and non-white races had approximately 150 percent better odds in engaging positively with the program whereas having a homeless housing status led to approximately 62 to 68 percent worse odds in responding positively to the program. While other variables presented by the COVID-19 pandemic were not well studied in this work and while this is an observational study, we hope that this program reflects the potential of these programs in reducing opioid dependence.

Dawei Tang

Neurobiology, FMP
Mentored by Edward Callaway, Daniela Cassataro

Investigating figure-ground stimulus processing in mouse primary visual cortex

The ability to separate a figure from its background, known as figure-ground segregation, plays an important role in object detection. Motion contrast separates figure and background through difference in motion direction and/or velocity magnitude. Based on behavioral data gathered using naturalistic figure-ground noise gratings stimuli, Luongo et al. suggest that mice are unable to perform figure-ground segregation in a motion contrast context. I aim to study motion contrast in mice using coherent random dot kinematograms and in vivo electrophysiology to investigate whether simple motion contrast stimuli can evoke population activity changes in mouse visual cortices and whether using these stimuli allow mice to perform figure-ground segregation.

Briana Thang

General Linguistics, McNair
Mentored by Emily Clem

Serial Verb Constructions in Teochew

Teochew, part of the Min Man language group, is predominantly spoken in Chaoshan, China and other parts of Southeast Asia. The focus of this study is on the dialect of Teochew spoken by Vietnamese people. Serial verb constructions (SVCs) are mono-clausal constructions that don't have any coordination, subordination, or complementation connecting multiple verbs. This research looks at Teochew SVCs and attempts to answer the following questions: which SVCs are attested in Vietnamese Teochew and how do the attested SVCs of Vietnamese Teochew differ from Mainland Teochew? Building off of Zheng's (2012) classification of Mainland Teochew SVCs, grammaticality and felicity judgements were collected from a speaker of Vietnamese Teochew. Based on preliminary results, five out of the six types of SVCs were found to be attested in Vietnamese Teochew: Instrument, Object Sharing, Benefactive, Cause-Result, and Motion-Event. While constructions may look like SVCs on the surface, a series of tests is needed to determine whether they are true SVCs or constructions involving covert coordination. Current work in progress includes applying the following tests: negation, content questions, multiple aspect, and temporal adverb tests. If apparent SVCs pattern differently from cases of overt coordination, this will provide evidence that they are true SVCs.

Kiko Thomas

Studio Art/Art, TRELS
Mentored by Anya Gallacio

Housing is A Right.

Installation is about theon going housing crisis in San Diego.

My family has never had financial stability or college education. Most family members did not even finish highschool. I was raised by a single mom and my grandmother. My mother is an amputee and my grandmother passed away from lung cancer. I've had to learn about higher education all on my own. I have had my own ups and downs, not having enough money to pay the bills. I decided to sacrifice nearly everything for my education.

I survive on a very limited budget and have lived in my vehicle on and off for years at a time. This is to solely focus on my education and art. I didn't have to worry about working to pay rent. I continue to face issues with poverty. I have overcome this challenge in that it has not hampered my work as an artist. It has fueled me to work harder. I've been able to succeed because of the support from many faculty, friends and the many social services. But most importantly I have shown the effort and sheer will to overcome any obstacles. I've learned that I value being an artist over everything. I will always create artwork and seek to educate those who are underprivileged.

I accomplished my goal of focusing on school and getting better grades. Since coming to UCSD I have increased my GPA from 3.50 to 3.64 and have been accepted in the Studio Honors Program.

I also accomplished my goal of creating a portfolio of artwork focusing on the destruction of civilization. This portfolio of work will not only advance my career; It will also help me continue my education in a Master's Degree program.

My goal is to not only be an artist; but also an educator and curator of art. My overall goal is to become an advocate for equality, justice and the experience of marginalised groups. I will be an example of someone who overcame adversity to succeed. When I accomplish these goals I will be an advocate for those who are in poverty that education is the solution.

Lu Tong

Gender study/ economics, FMP
Mentored by Yến Lê Espiritu

Illegal Immigrant and Shame Marriage in America: ChineseWomenâ€™s Struggle Across the Gendered Border

Against the backdrop of the US established family-migrant-dominated selective immigration system and a polarized narrative about immigrant women - the "innocent victims" who need to be protected by anti-sex trafficking laws and dangerous cunning liars. This study attempts to answer why some Chinese immigrant women choose to immigrate through sham marriages and how the power dynamic works between them and the agents and partners of their sham marriages.

Khoa Tran

Chemistry and Biochemistry, McNair
Mentored by Simone Hall

Identifying functional region(s) of the long non-coding RNA linc00883 in regulating human cell growth

There are many types of non-coding RNAs (ncRNAs) such as transfer RNAs (tRNAs), ribosomal RNAs (rRNAs), small nuclear RNAs (snRNAs) and long non-coding RNAs (lncRNAs). Despite not coding for any protein products, many non-coding RNAs still have functional roles in cells. The lncRNAs, in particular, have been shown to contribute to cellular regulation by controlling gene expression. Additionally, mis-regulation of lncRNAs is correlated with cancer progression in multiple cancer types.

The target of my research is the lncRNA linc00883. This lncRNA has already been identified as mis-regulated in colorectal cancer and prostate cancer. However, the functions of linc00883 in normal and diseased cells and the specific RNA region(s) necessary for its function have not yet been explored. Furthermore, the mechanism by which linc00883 interacts with proteins or other RNAs to produce normal and disease phenotypes has not been studied. In this research

project, my goal is to determine which specific RNA region(s) of linc00883 are important for its functions in regulating human cell growth. This study will expand our understanding of the function of the linc00883 lncRNA specifically, and potentially provide more information about the functions of lncRNAs in general.

Andy Trinh

Molecular and Cell Biology, FMP
Mentored by Dr. Stanley Lo

Examining Instructor Conceptions of Diversity

The current social climate has urged universities to commit to diversifying their student population and creating equitable, inclusive learning environments. Existing research has documented the pervasive problem of instructor biases, which impact how instructors perceive student behavior and interact with students with differing intersectional identities. Therefore, it is important to examine how instructors conceptualize diversity because the approaches they take when interacting with students reflect such values. Based on prior interview data from our group, three distinct conceptions of diversity were identified: the essentialist conception, the functionalist conception, and the existentialist conception. These have the perspectives of an instructor who is indifferent, accommodates, or builds on student diversity. The goal of the current study is to develop a quantitative survey informed by previous qualitative research to examine conceptions of diversity in a larger population of instructors across the nation. To create this survey, we reviewed research literature related to the three conceptions listed above and developed survey items on Likert-like scales. In our presentation, we hope to gain feedback on our survey items before we pilot them. The results of our study aim to provide insight into how instructors understand diversity in relation to their teaching and their students' learning.

Pacharadech Wacharanan

Physics, FMP
Mentored by Henry Abarbanel

Time Delay Embedding for Data Driven Regional Weather Forecasting

In this project, we are interested in applying a machine learning method, called Data Driven Forecasting, on regional weather forecasting. This project will not work with GCMs and their huge numbers of degrees-of-freedom, but with simpler models of the atmosphere called the shallow water equations (SWE). We will mainly focus on using a mathematical method, called Time-delay embedding on a 3-by-3 subsection in the center of the 10-by-10 SWE grid point. We vary the variable β , R ,and τ, in the range from 10-12 to 10-2 ,10-12 to 10-2, and 10 to 25. As a result, we can categorize these plots into mainly three subcategories: project completely different trend; the forecasting approaches zero or infinity or being approximately constant, project similar trend but less accuracy; the forecasting is not accurate but follow the data's trend, and project similar trend and accuracy: only β = 10-9 and β = 10-8, R = 10-6, τ = 17t. In conclusion, The variables β and R have a huge effect on the prediction. the variable β should be in the range from 10-9 and 10-7, and the variable R should be in the range from 10-9 and 10-6.

However, the variable τ affects the accuracy of the graph but doesn't have any huge impact on the projection. The best τ value is 17.

Erik Wieboldt

Neurobiology, TRELS
Mentored by Stanley Lo

Examining Instructor Conceptions of Diversity

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Yasmin Yacoubian

Biology, FMP
Mentored by Dr. Shyamanga Borooah

Optimizing CRISPR-Cas9 Gene Editing in Human iPS-derived Retinal Pigment Epithelial Cells Expressing Autosomal Dominant Inherited Retinal Dystrophy

Late-Onset Retinal Degeneration (L-ORD) is an autosomal dominant inherited retinal dystrophy characterized by formation of drusen deposits below the retinal pigment epithelial (RPE) layer, dark adaptation delay, photoreceptor cell death, early loss of central vision, and in the final stages of disease complete loss of vision. L-ORD is caused by a single missense mutation (S163R) in the C1QTNF5 gene. Recent developments in CRISPR-Cas9 gene editing now offer a solution to targeting this mutation and treating L-ORD, specifically by disrupting the faulty allele through a gene knockout approach. This project utilizes CRISPR-Cas9 to selectively target the S163R variant while preserving the wild-type allele *in vitro*. We validate editing at the S163R mutation site in human induced pluripotent stem cells (hiPSCs) through indel rate and restriction digest analysis. We hope this work supports the efficacy of CRISPR-Cas9 allele-specific editing, and ultimately contributes to a body of preclinical research that will assist in developing novel therapies to prevent sight loss in L-ORD.

Joanna Yang

Computer Science, FMP
Mentored by Imani Munyaka

Do you report your spam emails?

Many companies or even malicious entities not only took advantage and utilized the convenience of email to place advertisements, but also spread false information, or even harm email users. Study on interactions between individuals and spam email is an important topic to investigate for making sure that people are aware of these spam emails and will handle them appropriately to maintain the security of their personal information. In this research, our objective was to understand “How do people interact with spam emails?” Therefore, we create software using website to collect information from participants' gmail account. The website provide clear instruction, which leads participants complete the tasks step by step. Throughout the process, my role is to collect the necessary information such as warning messages that can help us analyze whether the spam emails are user-reported or google automatically filtered. The information we collected from those participants consisted of (1) warning messages, (2) timestamps for each spam email, and (3) the number of emails in the inbox as well as the spam folder. Then the script will store these data in separate documents. Other data such as contents, senders, etc, are neither collected nor stored. We have not started running the study with participants yet, but we expect that there will be more emails ending up in the spam folder due to email filtered functionality than those from users reporting.

Emmie Yao

NanoEngineering, TRELS
Mentored by Alis Balayan

3D Bioprinting of Cornea Stem Cells

The cornea is vital to the ability to see, as it controls light entry and focus. The cornea itself has three layers: the epithelium, the stroma, and the endothelium. The two main areas of the cornea this project focuses on is the corneal stroma and limbus which regenerates the corneal epithelium. The corneal stroma is a transparent, thick layer of the cornea that helps maintain mechanical shape and contains dormant keratocytes that are involved in wound healing and maintenance of transparency. The limbus forms the border between the transparent cornea and opaque sclera; it contains a population of stem cell/progenitor cells that regenerate the corneal epithelium, again maintaining corneal transparency. If either becomes damaged, the resident corneal stromal stem cells will attempt to repair the corneal stroma while the resident limbal stem cells will attempt to repair the limbus, but opaque scarring occurs and obstructs vision. The goal of this project is to repair and regenerate corneal tissue. Specifically, we use 3D bioprinting to create live tissue constructs and test for cell viability.

Kylie Yogi

Marine Biology, FMP
Mentored by Stuart Sandin

Size-Based Survival Analysis of the Scleractinian Coral Porites in the Pacific

The genus *Porites* consists of some species that are a more massive growth form and are more stress-tolerant, meaning they can survive in a much more variable environment that experiences disturbances such as storms. As temperatures rise and the frequency and magnitude of coral bleaching events increase, this study was conducted to determine whether the size of a colony can influence the tolerance and survival of coral colonies in a changing climate. This study hypothesized larger corals will have a higher survivorship than smaller corals but will more likely experience partial mortality. The relationship between size and full mortality and between size and partial mortality was tested using logistic regression with binomial predictors. Size and full mortality were observed to be significantly related ($p < 0.05$), with larger colonies more likely to survive into the next time point. Size and partial mortality were also found to be significantly related, with larger colonies more likely to experience partial mortality while smaller colonies, if they survived, were more likely to experience growth and fusion. Thus, larger corals were found to have a higher likelihood of surviving into the next year but have a higher probability of experiencing partial mortality and shrinkage. Future research can be conducted to observe any island-based patterns to determine how environmental factors can play a role in different sized colony survival.

Mingyu Yu

Mathematics, FMP
Mentored by Reuven Hodges

Pattern avoidance criterion for maximal sphericality in Coxeter groups

Maximal sphericality is a property of elements in a Coxeter group related to the geometry of a class of objects called Schubert varieties. Hodges and Yong in 2020 proposed a pattern avoidance conjecture for the Coxeter group of type A_n that characterizes the maximal spherical elements via a pattern avoidance criterion. We extended the pattern avoidance conjecture to Coxeter groups of type B_n and D_n. The conjecture for Bn is that a permutation w in B_n is maximally spherical if and only if it avoids a list of 87 patterns. The conjecture for Dn is that a permutation w in D_n is maximally spherical if and only if it avoids a list of 436 patterns.

Tasnim Yusuf

Department of Emergency Medicine, FMP
Mentored by Edward M. Castillo, PhD., MPH

Understanding The Relationship of Key Demographic Indicators on COVID-19 Rates in Emergency Department Settings During Surges

Study Objectives: Coronavirus disease 2019 (COVID-19) continues to have a disproportionate impact on certain populations, particularly racial and ethnic minorities, persons experiencing homelessness, and people living with comorbidities. The purpose of this study was to examine the differences in COVID-19 positivity rates between two surges among key demographic groups.

Methods: This is a cross-sectional study to assess the differences in COVID-19 positive patients from the December 2020-January 2021 and December 2021-January 2022 COVID-19 surges from two Emergency Departments (EDs). One ED is an urban academic hospital, and the other is a suburban quaternary medical center with a combined annual census of approximately 85,000 visits. Pearson's Chi-square test was used to test the goodness-of-fit of age, race, ethnicity, BMI, and comorbidities using the Charlson Comorbidity Index. Pearson's Chi-square test of independence was used to test homelessness status. A p-value less than 0.05 was used to indicate statistical significance.

Results: During the 2 surges, 11,634 patients were tested for COVID-19 in two ED settings where 2,126 patients were confirmed positive (18.3%). Of these, 811 (38.1%) identified as Hispanic, 1,316 (61.9%) identified as a non-White, 1,434 (67.5%) reported one or more comorbidities, and 1,262 (59.4%) had a BMI ≥ 25.0. Homeless status was reported among 227 (13.0%) individuals. The Chi-square independence test showed that homelessness status was not statistically significant between the first surge and second surge ($\chi 2 = 1.96$; df = 1; p=.16). The distribution of COVID positivity in ED settings between the two surges were statistically significant among race ($\chi 2 = 43.09$; df = 4; p<.01) and ethnicity ($\chi 2 = 22.15$; df = 2; p<.01) groups. BMI ($\chi 2 = 19.56$; df = 3; p<.01) and comorbidities ($\chi 2 = 49.47$; df = 3; p<.01) were also consistent with literature.

Conclusions: Our findings suggest ethnic and racial minorities are still disproportionately affected by COVID-19 based on the 2020-2021 and 2021-2022 holiday surges. Findings also support that those with higher BMI and multiple comorbidities place individuals at higher risk of seeking emergency care. Homelessness status was not statistically different between surges in ED settings. However other contributing factors such as access to testing sites were not included in this data that may be attributed to this finding. Further studies should evaluate the impact of community outreach focused on these higher risk populations and the impact on care utilization and outcomes.

Juanyu Zhang

Biological Science, FMP
Mentored by Tony L. Yaksh

Identifying Joint-Innervating Sensory Neurons in Dorsal Root Ganglion

Arthritis is the inflammation of joints, which leads to joint pain and stiffness. Although joint pain is induced by inflammation in the joint synovium, the pain can persist after the inflammation is resolved. Our current work aims to understand the underlying mechanism behind post-inflammatory joint pain. Our approach is to determine the transcriptomes of the cell bodies of the sensory neurons innervating joint synovium, which are in the dorsal root ganglia (DRG), in the normal animals and in animals with an inflamed joint. In order to perform transcriptomes

analysis for cell bodies in DRG, it is important to know 1) how many neurons in DRG are responsible for the joint innervation; 2) what types of fibers are these cell bodies in the DRG connected to; and 3) what is the change in the quantity of these fibers during arthritis. To address this question, we injected Fast Blue into Mice's ankle joints, and performed fluorescence-activated cell sorting to identify the joint-innervating sensory neurons in DRG.

Andrew Zhang

Neurobiology/Neurobiology, TRELS
Mentored by Haoming Wang and Dr. Gulcin Pekkurnaz

Spatiotemporal Regulation of Neuronal Metabolism

Glycolysis is a cytosolic enzyme pathway that produces small amount of ATP and generate substrate for mitochondria's more powerful ATP generation. Neurons' sole source of energy is glucose and have large energy demand in located areas in elongated axons.

Increased glucose up-regulates O-GlcNAcylation, a nutrient sensing post-translational modification. A trace amount of glucose entering the cell goes through hexosamine biosynthetic pathway (HBP) and converts to UDP-GlcNAc. Enzyme O-GlcNAc Transferase (OGT) then facilitates the process of O-GlcNAcylation.

Hexokinase-1, the first enzyme of glycolysis and the only Hexokinase isoform in neurons, can be modified through O-GlcNAcylation and anchor at mitochondrial surface. All nine other glycolytic enzymes can also be modified through O-GlcNAcylation. Once modified through O-GlcNAcylation, they aggregate mitochondrial surface and form a metabolic complex that enhances ATP production.

Cindy Zhang

General Biology, FMP
Mentored by Huilin Zhou

2-Step Purification of Psf2 for Mass Spectrometry Analysis

Proteins interact with each other in dynamic complexes to provide function on the cellular level. Therefore, characterizing the form and structure protein complexes is essential to understanding their functionality in the cell. One method to quantify protein-protein interactions is by isotope mass spectrometry. We will use mass spectrometry to characterize the formation of the CMG complex. We lysed yeast cell lines HZY1883 (Psf2-TAF) and HZY2329 (untagged), and then purified the protein Psf2-TAF with a 2-step immunoprecipitation process. We analyzed the amount of target protein recovered using a Western blot analysis. We will perform a silver staining to analyze the noise of our samples. We will then quantify the CMG complex using mass spectrometry.

Tianxing Zhou

Physics, FMP
Mentored by Adam Burgasser

Resolved Binaries with M and L Dwarf Companions Identified in Gaia eDR3

We present a curated sample of 7197 resolved binaries containing M and L dwarf companions within 400 pc of the Sun, identified in Gaia EDR3. These sources were selected from the compilation of El-Badry et al. (2021), and vetted using absolute magnitude, color, galactic latitude, separation, and co-moving proper motion selection criteria. We conducted verification and preliminary evaluation of the properties of these systems using additional photometric and astrometric data from SDSS, Pan-STARRS, 2MASS, UKIDSS, and WISE. Analysis of the literature indicates primary spectral types of B8–M8, including 178 white dwarfs, 1 subdwarf, and 35 subgiants/giants; and secondary spectral types of M0–L1.5, including 63 systems with ultracool dwarf components. Only 13% of these systems have been previously reported as co-moving pairs, and only 4% of the primaries and 1% of the secondaries of these systems have published spectral classifications. Follow-up of this expanded low-mass companion sample will provide a valuable benchmark sample for precisely calibrating the physical properties of the lowest-mass stars and brown dwarfs.

Jinxu Zhou

Nanoengineering, FMP
Mentored by Vicki Grassian

Interactions of Dimethyl Succinate on Indoor-Relevant Surfaces

Because dimethyl succinate is used extensively indoor these days, we want to study how they affect the indoor air environments. In this study, we are investigating how dimethyl succinate interacts with a series of common indoor surfaces: does it only adsorbs/ desorbs? Will chemical reactions happen? How sticky is DMS on these surfaces? These questions will lead to an interesting study about a chemical that we are exposed to on a daily base but don't pay much attention to.

Langrun Zhu

Data Science, FMP
Mentored by Johan Perols

House Prices - Comprehensive Data Exploration & Comparison

Housing price is a fundamental problem in modern society. And predicting the future housing price is not only a question that people who need to purchase their new house, but also for economists, computer scientists and data scientists. Housing price prediction, or in a more professional term, real estate economics, has become an important research topic not just since the day investment on real estate start to be popular, but even from the very beginning of the history of settlement. My project will focus on comparison between different prediction models

based on data from Kaggle house Prices competition and figure out the pros and cons of different validation methods and predictions models.