Abstracts

Individual Projects H–N

Molecular Identities of Transplanted Medial and Caudal Ganglionic Eminence Cells in Mouse Visual Cortex
Mariyam Habeeb  
*Mentor:* Sunil Gandhi

The maturation of inhibitory neurons is responsible for the opening of a critical period for the development of the binocular visual system. Recently, the transplantation of embryonic inhibitory neurons from the medial ganglionic eminence (MGE) into an adult visual cortex has been shown to reactivate juvenile plasticity in the host circuitry. In contrast, transplantation of inhibitory neurons from the caudal ganglionic eminence (CGE) does not induce new plasticity. In order to investigate how MGE transplantation reactivates plasticity, we examined the cell subtypes and laminar distribution of transplanted inhibitory neurons derived from the MGE and CGE. We found that transplanted MGE and CGE cells develop into different cell types; MGE cells express Parvalbumin and Somatostatin, whereas CGE cells express Somatostatin and vasoactive intestinal peptide. In addition, we found that the laminar location of transplanted MGE cells reflect the endogenous distribution, whereas transplanted CGE cells do not. This data provides a direction for future studies that seek to find which cells are responsible for creating the critical period.

Age-Associated Mechanisms Increase Respiratory Infections
Pega Hajian  
*Mentor:* Anshu Agrawal

When a foreign particle is present in the human body, the body’s immune system is activated and pro-inflammatory cytokines are released by myeloid dendritic cells (MoDC). However, as we age, the basal activity of this activation increases, causing chronic inflammation in the elderly population. The purpose of this study was to determine the effect of this inflammation on epithelial cells. Young and aged MoDCs were used as the two control groups. Each group was stimulated by a virus, which were the experimental groups. The MoDCs were cultured, and then incubated with epithelial cells. A variety of antibodies were used to stain the epithelial cells to see which receptors were activated in this process. The results showed that the epithelial cells cultured with young MoDCs had a larger change in protein expression (E-cadherin, CD54, HLA-A, B, and C) when stimulated by the virus, while the aged MoDCs had no change between the cells alone and the stimulated cells. However, epithelial cells cultured with unactivated aged MoDCs also showed changes in the above proteins suggesting an increased basal level of activation which does not increase on infection with the virus.

Analyzing Force-Extension Curves to Study Biophysical Differences in the Activation Notch Signaling
Janelle Halog  
*Mentor:* Elliot Botvinick

Notch signaling is a conserved signaling pathway, which plays a significant role in homeostasis and development of many tissues. Abnormal Notch signaling is involved in many developmental diseases such CADASIL and cardiovascular defects, cancers, and more. Hence, achieving understanding of the pathway’s mechanism of activation and modulation is necessary for developing therapeutics against Notch related diseases. To address this issue, force-extension curves were obtained from optical tweezers based force spectroscopy of ligand-Notch interactions. These curves were classified into five different classes (C1, C2, C3, C4, and C5). This was done for five different conditions: LC (endogenous), L (endogenous and ectopic Wildtype), N (endogenous and ectopic Wildtype), D (endogenous and ectopic DFC mutant), and TMHA-14 (endogenous and ectopic NRR mutant). When the classes were compared across all conditions, C1 had the least work with C4 being the next dominant class having more work than all the groups. D and TMHA-14 had more of C4 as compared to the other conditions, showing that D and TMHA-14 are high-energy groups compared to L, LC, and N. These results indicate that a mutation in the ectopic region of the Notch ligand causes its interaction with Notch to require more energy in order for it to occur.

Detection of Oscillating Electric Fields by Laser Light Backscattered from Atmospheric Dust
Jeffrey Hamilton  
*Mentor:* Roger McWilliams

Oscillating electric fields can be detected via scattered laser light from atmospheric dust. Using a frequency-doubled Nd:YAG laser at 532 nm, time-dependent photomultiplier signals and video images were taken of scattered laser light from dust oscillating in controlled electric fields up to 6.5 kV/cm at distances up to 5 m and frequencies ranging from 40–100 Hz. This is a promising diagnostic to test utility power line activity without climbing a transmission line tower.
Marine Extracellular Enzyme Response to Acidification in Coastal Southern California
Nasser Hasan
*Mentor:* Steven Allison

Extracellular enzymes can significantly change nutrient ratios in the ocean through the breakdown of organic matter. Climate change models show that the oceans can be expected to acidify up to 0.4 units by 2100 and that marine organisms across many trophic levels will be effected by this rapid change. I hypothesized that extracellular enzyme activity would decrease as a pH decreased and tested this hypothesis by measuring the potential activities of four different extracellular enzymes at six different pHs using substrates tagged with fluorophores. My results indicate that the rate of organic phosphorus breakdown by alkaline phosphatase will decrease significantly with decreasing pH but that other extracellular enzymes will have higher activity, releasing more carbon and nitrogen from the organic pool. The different directions and magnitudes of change in extracellular activity indicate that nutrient ratios and primary productivity in the oceans will change as a result of ocean acidification.

The Criminalization of Blackness
Faye Hayes
*Mentor:* Tiffany Willoughby-Herard

Blackness has become intrinsically associated with crime. That is to say that there is a public consensus about Black people being more associated with crime as if it is a part of their nature when, in fact, White people are arrested at higher rates than any other racial group (FBI, USA). One must ask why despite this information, Black people continue to be seen as more violent than any other racial group. I argue that a huge factor that influences the way Black people are viewed is print news media that labors to criminalize the Black body. Print news media representations of Black people tend to depict them as violent perpetrators, savage, and uncontrollable. This paper seeks to prove that public opinion and the vilification of Black people in print news media creates a culture of abuse against them. Mass incarceration is a direct symptom of Eurocentric dogma that says that these bodies need to be policed more than others. I compare national newspaper coverage in the historically White press versus the Black press within the last ten years in order to explore the differences in how they describe Black people’s relationship to crime and violence. In particular, I am concerned with the tropes “Black on Black violence,” and clusters of terms that imply that Black people are “inherently violent.”

France, The Dreyfus Affair and the Great War: The Paths of Glory Lead but to the Grave
Lisa Haygood
*Mentor:* Kai Evers

Rarely has an event defined a national era so significantly as did the case of the falsely accused and imprisoned French/Jewish army captain Alfred Dreyfus in 1894. Shadows of the dark influence of anti-Semitism fueled pre-war French national identity, disgracing the army and dividing the National Assembly. What was a domestic issue for France in the 1890s erupted into international scandal when Émile Zola published his open letter to President Faure in L’Aurore in 1898 condemning the miscarriage of justice by the Army and politicians. Resolved in 1906 with Dreyfus’ exoneration and restoration to rank, those eight years of public debate deeply divided France before and throughout the Great War. Early French and later international filmmakers sought to narrate the breakdown of French state and civil society through a national lens and against the social and political imprint left by the Affair. Such prospective forms the interconnected structures of three unique yet distinctly different discourses on the traditional war film: Abel Gance’s sweeping epic J’Accuse (1919), Jean Renoir’s emotive La Grande Illusion (1937) and decades later, Stanley Kubrick’s ethical dilemma Paths of Glory (1957). In the dialogues that Gance, Renoir and Kubrick strived to initiate through their films, each would agree with sentiments expressed by former French President Chirac during the centennial commemorations of Dreyfus’ vindication in 2006. Chirac praised Dreyfus’ rehabilitation as a rejection of anti-Semitism and a victory for human rights, concluding that the fight against the dark forces of intolerance is never definitively won. We must remain vigilant.

Capacity Building for a More Sustainable Food System in Central Santa Ana
Timothy Hendrix
*Mentor:* Doug Houston

State legislation requires the reduction of Greenhouse Gases (GHGs) through the California Global Warming Solutions Act, and the diversion of organic waste from landfills through the Solid Waste: Diversion Act. As a part of the community-based initiative, KidWorks, the Santa Ana Compost Action Team has collected and composted over 4,000 lbs. of organic waste in a three-month period from approximately 25 families in their surrounding neighborhood via bicycles. The purpose of this research was to identify and investigate items of the action team deemed necessary for increasing capabilities. Using the Socio-ecological model, relevant policy and community interactions were summarized to provide a more rich contextual understanding. Methods of
compost monitoring were developed and piloted to create documentation of the decomposition process that may be reflected on and changed to optimize a final soil amendment. Bike computers were used in a pilot study to keep track of bicycle miles travelled, so the data can be converted into emissions saved such as particulate matter and carbon dioxide (CO₂). Finally, the Santa Ana Compost Action Team Handbook was updated to reflect the most recent operational changes proposed in this paper as well as adding more in-depth safety information about each activity undertaken. This youth-led action team has continued to sustain their relationships within the neighborhood and remain a viable addition to the municipal run waste diversion program in Central Santa Ana.

An Integrated Microfluidic Device to Dissociate Tumor Tissue Samples
Katrina Henrikson
Mentor: Jered Haun

Cancer is defined as a class of diseases characterized by uncontrolled growth and spread of cells. Today, cancer accounts for approximately one in seven deaths worldwide. As cancer treatments develop and progress, it has become clear that molecular and mechanical worldwide. As cancer treatments develop and progress, it has become clear that molecular and mechanical diagnostics are a valuable tool in identifying important characteristics of each cancer, such as expression patterns, in order to create specific and targeted treatments. To perform these analyses on a sample, a biopsy or fine needle aspirate sample must be dissociated into single cell suspensions. There is a clinical need for a method to break down samples in a timely manner that also leaves cells viable for further analysis. The Haun Lab has created a microfluidic device which mechanically dissociates and disaggregates tumor samples in order to produce a suspension of viable single cells. The dissociation device, previously demonstrated to effectively dissociate cultured spheroids, has undergone multiple design variations in AutoCAD in an attempt to optimize the device. These designs underwent fluid simulations in COMSOL, and were tested in the lab in order to determine the ideal configuration of the device to maximize single cell yield. A filter membrane device used in conjunction with the dissociation chamber was also redesigned in Solidworks. It was then fabricated and tested in order to determine the ideal filter pore size to selectively retain any remaining aggregates from the dissociation device.

Leadership and Gender on Campus Organizations
Alejandra Hernandez
Mentor: Francesca Polletta

At a time when there are as many women undergraduates as men, one might expect that women would be as likely as men to be campus leaders. Research on women in organizations, however, has found that women face difficulties in exercising leadership. What is accepted as effective leadership in men is often seen as overly assertive in women. Accordingly, women seem to be most effective by exercising a more participative style of leadership. The question is whether this is true also of leadership among college students. This is the time when young adult people are defining their adult identities; for that reason, how they exercise leadership and how they evaluate it is important to understand. Here, I compared the leadership styles of college women and men through ethnographic interviews about their organization. Results showed that when an organization is hierarchal students still lead in a participative way whether they were female or male leaders. Two vignettes with participative and directive characteristics were also used in the interviews. The vignettes showed more female and male participants appreciating a participative style of leadership than directive style of leadership for campus organizations. Overall, women and men student leaders tend to lead in a participative and directive style of leadership interchangeably.

Investigation of Bacterial and Viral Removal Efficiency through Different Wastewater Treatment Processes
Dana Hernandez
Mentor: Sunny Jiang

With the increase of water scarcity, reuse of wastewater is considered as a new alternative to supplement current water supplies. Municipal wastewater after tertiary treatment can be recycled for many non-potable purposes, such as agriculture and landscape irrigation. A local water recycling plant recently completed its expansion project and now includes a membrane bioreactor (MBR) in addition to its conventional activated sludge (CAS) system. Compared to the traditional system, MBR has a smaller environmental footprint as the sedimentation tank and dual-media filter functions are combined through the membrane filtration process. These dual systems provide a unique opportunity to carry out a comparative study on pathogen removal efficiencies for water reclamation because it is critically important to understand the removal of bacteria and viruses during water treatment in order to protect public health from reuse of treated water. A flow cytometry (FCM) method was adopted to enumerate bacteria and viruses in treated wastewater samples collected from different phase of the treatment. FCM is a rapid method for enumeration of biological particles stained with high intensity fluorescence nucleic acid dyes. Compared to traditional culture based methods, FCM offers high-speed and sensitivity to quantify the pathogens in water. After eight months of
data collection, the results demonstrated that the MBR process is more efficient than the CAS process as it realized a $4\log_{10}$ virus removal and $6\log_{10}$ bacteria removal. After tertiary treatment in the two processes, both virus and bacteria were below the detectable level of the current method indicating the adequacy of the water treatment process for non-potable reuse.

UC Irvine Undergraduate Student Attitudes and Beliefs regarding Eating Disorders
Edgar Hernandez
Mentor: Zuzana Bic

An eating disorder (ED) is classified as a psychological disorder that negatively distorts an individual’s perception of themselves in terms of their food consumption and/or body image. In addition to the detrimental physical and mental harm, individuals with EDs must also deal with the pervasive social stigma surrounding this disorder. Recent literature has revealed a higher level of stigmatization towards EDs among males in comparison to females. This study aims to determine whether higher levels of personal stigmatization towards EDs exist among males in comparison to females. A confidential online survey was administered to undergraduate students, 18 years of age or older, at the University of California, Irvine. This questionnaire was composed of 14 Likert scaled questions that were restructured from the original Stig-9 in order to specifically measure an individual’s perceived stigmatization of EDs. Since this study is comparing two independent groups using an ordinal measurement scale, a Mann-Whitney U test was used to determine statistical significance. The data collected from the 206 participants (155 females: 51 males) revealed a statistically significant difference in the overall stigma score between males and females. Further assessments of this phenomenon should be conducted at other universities in order to investigate whether a higher level of stigmatization towards EDs among males is endemic among the college population. Also, future investigations should attain an equal number of male and female participants in order to ensure validity.

#Queer Community
Jessica Hernandez
Mentor: David Frank

The concept of community has become an important aspect to online culture. Online communities have been largely debated academically as they do not follow what has been traditionally thought of as a community. The traditional Sociological meaning of the term can be as little as a group of people in one geographical location or as much as including social structures and community spirit as well. Twitter is an asymmetric platform in the form of communication style, meaning a user can post something but it does not require a response. By some accounts this may be reason to dismiss Twitter as a community. Anatoliy Gruzd, Barry Wellman, and Yuri Takhteyev have made the argument for the inclusion of Twitter into this category by using Jones’s work on “virtual settlements.” The study of hashtags illuminates the way in which users communicate with one another, how these styles can be used to establish the boundaries of a community within Twitter, and on a fundamental level how online community forms. Using the Queer community as the case study, specific hashtags pertaining to this group were selected as focal points. Through this study of the queer community it becomes evident that there are specific ways in which hashtags can be used. Although the words themselves can remain static the meanings behind them are subject to change. This reveals a change in social meaning and gives way to new phrases and words.

Undergraduate Conceptions of Success and Failure: A Consensus Analysis
Jorge Hernandez
Mentor: Katherine Faust

The cultural consensus theory (i.e. CTT) provides three things: a way of determining whether the observed variability in beliefs is cultural or idiosyncratic, the measurement of each individual’s competence of shared knowledge, and the culturally correct answer to questions asked of the informants, with respect to the given domain of knowledge. The purpose of this study is to implement a cultural consensus methodological approach that will allow for the exploration of undergraduate conceptions as “cultural knowledge” about factors associated with being a successful or an unsuccessful university student. Extensive literature over the early integration experiences of first-generation college students compared to non-first-generation students reveals both associated advantages and disadvantages. For example, a longitudinal study from The National Study Center of Education Statistics (NCES) reported that among 12th graders who enrolled in post-secondary education, 46 % of non-first generation students received a Bachelor’s Degree, compared to only 24 % of first-generation students. Results revealed that first-generation students’ experiences and conceptions of success were similar to those who self-identify as non-first-generation. For this study, I will provide the culturally correct answers about indicators that attribute to the beliefs of successful and failure by university students who self-identify as first-generation or non-first-generation. Compared to non-first-generation university students and according to the culturally correct answers elicited thereof, I predict that first-generation students will demonstrate greater
disparities in the distribution of characteristics regarded as successful/unsuccessful.

I Open
Caitlin Hicks
Mentor: Loretta Livingston
The series of pieces I have strung together for this concert examines the stages through which a human might pass to reach a place of personal fulfillment. My research was initially focused on the dancer’s experience of seeing and being seen, and eye focus is still a strong theme in the choreography and ideas behind it. The structure of the work is also greatly influenced by Abraham Maslow’s Hierarchy of Needs and Mihaly Csikszentmihalyi’s experience of “flow.” The connection of flow and dance was first brought to my attention by Sibyl Kleiner’s 2009 article “Thinking with the Mind, Syncing with the Body: Ballet as Symbolic and Nonsymbolic Interaction.” As Kleiner points out, professional dance performance is a prime opportunity to experience flow as it is technically demanding but carried out by individuals with a highly honed skill set. However, I would hope that dance might be such a conduit to flow for those with less extensive dance training as well, and my thesis concert is largely focused on the experience of a human, not a dancer.

A Flow Reactor Approach to Reductive Spiroannulation
Kimberly Hilby
Mentor: Scott Rychnovsky
The pharmacological uses of azaspirocycles and its presence in many natural products are well documented in the chemical literature. This project focuses on the expansion of reductive lithiation methodology to improve the substrate scope and synthesis of azaspirocycles. This improvement in methodology applies flow chemistry to our standard methodology, to produce spirocycles in a flow reactor by reacting the spirocycle precursor with Lithium Di-tert-butylbiphenylide (LiDBB). Several of these precursors have been synthesized with the ultimate goal to see how varying functional groups affect yield and diastereoselectivity. To help more fully understand the reaction mechanism and the products formed by reductive lithiation, standards of four side products, that are thought to be produced from two previous test reactions, have been synthesized. These side products, all secondary BOC amines, were run on gas chromatography and matched to the side products from the formation of these spirocycles allowing us to match a retention time and confirm an identity of these side products. Identification of these byproducts allows for further optimization of the flow reactor conditions which would hopefully lead to conditions where these side-products are only produced minimally or eliminated completely. By the time of the Symposium more data will be available to present.

Understanding the Relation between Napping and Memory in Infants
Julia Hillendahl
Mentor: Angela Lukowski
Previous research indicates that sleep, including daytime naps and nighttime sleep, facilitates recall memory. However, despite recognition that infants spend the majority of their first two years of life asleep, there is limited understanding of the functional benefits of sleep in terms of cognitive performance. The present study was conducted to examine whether daytime napping facilitates recall memory and generalization across cues in 13-month-old infants. Twenty-one families participated in two sessions separated by a tow-hour delay; families were randomly assigned to complete their sessions over durations of time during which their infant was expected to nap or remain awake. Recall memory and generalization across cues were assessed using of an elicited imitation task. Recall was assessed after the two-hour delay by presenting infants with the same sequences they saw at the first session, whereas generalization across cues was assessed by presenting infants with sequences that were functionally identical but perceptually distinct to those used at the first session. Data collection is ongoing. However, preliminary analyses revealed that time spent napping during the day was positively correlated with the number of target actions produced and memory for temporal order information at immediate imitation across conditions. The duration of naps was also positively correlated with memory for temporal order information after the two-hour delay across the memory and generalization conditions. These preliminary findings suggest that daytime sleep habits are associated with memory in infancy.

Social Skills Intervention and Recall Memory in Children with Down Syndrome
Julia Hillendahl
Mentor: Angela Lukowski
Research indicates that early intervention programs improve both physical and cognitive outcomes in children with Down syndrome (DS). Previous studies have shown that children with DS have natural social imitation abilities, but none have examined whether additional social skills therapy enhances their cognitive functioning. The present study examines the role of social skills intervention on the recall memory and generalization abilities of children with DS. Young children with DS completed a two-session study. Recall memory and generalization were assessed using elicited
impression; parents completed questionnaires about children’s diagnostic and intervention history. Results indicated that children with DS who had received social skills therapy performed better on measures of recall memory at immediate imitation relative to those with no exposure, in that they were able to complete a greater number of target actions in the correct temporal order, due to apparent strengths in memory encoding. These findings call for systematic examination of the benefits of social skills intervention for children with DS.

**Directed Evolution through the Incorporation of Unnatural Amino Acids**

Justin Hitomi  
*Mentor: Chang Liu*

Recent research has shown chemokine receptor CCR5 plays a key role in human immunodeficiency virus’s (HIV) ability to infect cells. The infection is accomplished through the binding of the coat protein gp120 to CCR5. Human patient-derived anti-HIV antibodies have been discovered to effectively neutralize HIV. Among these antibodies, a common motif includes tyrosine rich regions, which were found to play an important role in binding to gp120. These tyrosine residues are converted to sulfotyrosine through the post-translational modification called tyrosine sulfation. Naturally, tyrosine sulfation requires specific sequences around the tyrosine, which signals for it to be sulfated. While this is true in nature, with new technology, the sulfotyrosines can be incorporated without these sulfation sequence constraints. In collaboration with a graduate student, I will research whether the binding affinity of E51, a highly effective, sulfated HIV-neutralizing antibody, can be further enhanced by searching for high gp120 binding residues to replace the sulfation sequence constraints. A stronger antibody is believed to exist because in a lab setting the entire spectrum of amino acid sequences can be tested without the limitations set by nature. After rounds of directed evolution, we discovered sulfated antibodies that do not contain sulfation sequence motifs and bind gp120 better than E51.

**Evaluating the Effect of Electromechanical Reshaping of Rabbit Temporomandibular Joint**

Arlene Ho  
*Mentor: Brian Wong*

Temporomandibular joint (TMJ) disorders affect approximately 11 million adults in the United States and at least 70% of these cases involve pathology or displacement of the articular disc. Currently, disc repair and replacement techniques are quite invasive and many times ineffective or permanently damaging. This study serves as an introductory study to explore the effects of electromechanical reshaping (EMR) on TMJ articular discs harvested from New Zealand white rabbits and kept in culture *ex vivo*. Previous studies using EMR as a reshaping mechanism have been successful, especially in regards to cartilage alteration. The articular disc, being constructed of similar tissue, also had the potential to be changed through this process. After retrieving TMJ articular discs from the rabbits post-mortem, four discs were washed and kept in culture for varying amounts of time. Each disc was bisected and two needles were inserted 3 mm apart in the tissues, each undergoing EMR at two different dosimetry parameters (4 V for 30 seconds and 4V for 1 minute). Photos were taken of the tissue and confocal microscopy was used to analyze and observe changes to the tissue.

**The use of the Kindling Model in TBI Rats: Can Human Neural Stem Cell Transplants Reduce Seizure Susceptibility?**

Daniel Ho  
*Mentor: Brian Cummings*

The CDC estimates reveal that approximately 1.7 million new traumatic brain injuries (TBIs) occur in the US every year, carrying with them an astounding death toll and an estimated cost of over $70 billion. These injuries have been characterised as causing disabilities in cognitive processes, sensation, movement, memory, and emotion in both rats and humans alike, and prior studies done by the lab have shown TBIs to have a defined effect in long term (>2 month post injury) cognitive and emotional behaviours. In addition to these cognitive and emotional disabilities, TBIs have also been shown to provoke the development of epilepsy in more than 50% of TBI cases in humans. This study seeks to use the Kindling model, a model of repeated electrical brain stimulation to induce seizures, to ultimately determine whether human neural stem cell transplants have any effect on seizure susceptibility and on behavioural performance post kindling. The pre-kindling behavioural data can also be used to answer the question of the extent of damage caused by TBIs, and whether stem cell transplants can have possible therapeutic outcomes in injured rats, and preliminary data indicate that injured animals perform worse in behavioural tasks than uninjured animals.

**Low-Cost, Quantitative 3D Structural Imaging of the Nose and other Facial Features using Open Source Software**

David Ho  
*Mentor: Brian Wong*

For facial reconstructive surgery, quantitative 3D imaging is often used to create volumetric representations of human facial features. Quantitative 3D imaging can be used to rigorously track changes in nasal morphology and provide numerical outcome representations of human facial features. Quantitative 3D imaging is often used to create volumetric representations of human facial features. Quantitative 3D imaging can be used to rigorously track changes in nasal morphology and provide numerical outcome representations of human facial features.
measures. However, commercial 3D imaging systems are expensive. This study describes how open-source software and consumer cameras can be used to perform this task inexpensively and efficiently. 123D Catch, developed by Autodesk, was used to generate the 3D representation of the 3D printed silicone nasal model derived from computed tomography. The 3D model provided a Lambertian reference standard to consumer digital cameras including the Samsung Galaxy S5, Canon Rebel XTS, and Canon Rebel T5i. Diffused illumination was used. Total image number was varied along with imaging using surface registration landmarks. Point clouds were created and CloudCompare, an open source program, was used to compare each camera reconstruction with the CT data from which the model was derived. Next, imaging of subjects’ noses was performed, and software measurements were compared with those directly measured using a micrometer. Results have showed that 123D Catch accurately provided 3D nose and facial representations after mesh comparison with CloudCompare by merging and aligning point clouds of the 123D Catch and CT data. In addition, 123D Catch can clearly reconstruct both inanimate objects and facial attributes with excellent accuracy.

123D Catch can be used as an inexpensive, alternate method to 3D reconstruct the nose compared to 123D Catch can clearly reconstruct both inanimate objects and facial attributes with excellent accuracy. 123D Catch can be used as an inexpensive, alternate method to 3D reconstruct the nose compared to commercial 3D programs.

Analysis of the Role of TGF-β/Activin Signaling in *Drosophila* Metamorphosis and Regulation of the Ecdysone Pathway

Huy Ho

*Mentor:* Kavita Arora

This study focuses on understanding the mechanism by which Transforming Growth Factor-β (TGF-β) signaling regulates ecdysone responsiveness during metamorphosis in *Drosophila*. Both signaling pathways are critically important modules, and disruption of these pathways result in developmental defects and diseases. Previous studies showed that mutations in *myoglianin* (*myo*), a gene that encodes a TGF-β/activin related ligand, displays many phenotypes similar to animals that lack ecdysone signaling, suggesting that the two pathways are linked. This study focuses on one aspect of the *myo* mutant phenotype, the persistence of salivary glands during early pupal development. Previous work indicated that the Myo receptor Babo was required in the nervous system to regulate ecdysone receptor (EcR) expression and consequently apoptosis of the larval salivary glands. In this study, we used the Gal4/UAS system to disrupt either ecdysone signaling or TGF-β signaling in a tissue specific manner to further narrow down the group of cells that require ecdysone signaling to regulate salivary glands cell death. Our data indicates that a subset of neuropeptide secretory cells that use acetyl choline as a neurotransmitter is critical for salivary gland cell death.

The Ups and Downs of Repeated Study: An fMRI Investigation of Competitive Memory Trace Interference

Huy Ho

*Mentor:* Michael Yassa

Currently many theories assume that repeated study improves memory representations. We recently proposed Competitive Trace Theory (CTT), which challenges this assumption. CTT considers the hippocampus’ powerful ability to orthogonalize even very highly overlapping inputs into distinct outputs for memory storage. From this theory, we have hypothesized that repeated study of an identical stimulus can induce highly similar but not perfectly overlapping memory traces, which can compete for representation during retrieval. This would result in a more stable, but less detailed memory of the information. We observed evidence for this effect in a behavioral experiment, and collected high-resolution fMRI to study the neural mechanisms of this trade-off. We found repetition-related modulations of activity across the medial temporal lobes, frontal lobes, and parietal cortices. We furthermore observed evidence of interaction between the hippocampal and neocortical regions when exposed to repeated study materials and subsequent memory judgments over these items. These results support the Competitive Trace Theory and might further suggest that repeated interactions with stimuli accelerate the systems memory consolidation process via competitive trace interface, resulting in more stable “semantic” memories at the expense of “episodic” details for a given memory representation.

Characterization and Quantification of Amyloid Aggregates using Conformational-Dependent Monoclonal Antibody, M31

Margaret Ho

*Mentor:* Charles Glabe

It has been shown that aggregated proteins are at the basis of most common age-related neurodegenerative diseases such as Alzheimer’s disease. Extensive research is currently being conducted to eradicate the disease. One possible method to detect the proteins include monoclonal antibodies that have the ability to recognize specific regions of Amyloid-Beta (Aβ) epitopes, making them conformational-dependent antibodies. M31, an antibody produced in the lab, is known to recognize Aβ42 and Aβ40; however, it is unclear as to what the minimum aggregate size M31 recognizes. In my project, I will be: (1) identifying which protein size M31 selects for using a Western blot, (2) using this information I will then perform an Immuno-precipitation in order to...
using the M31 antibody as a biomarker for Alzheimer’s disease. These plaques, although related, have been shown to be conformationally distinct from vascular amyloid which are exclusively recognized by the antibody M31. The ability to purify this unique aggregate will be instrumental in conducting experiments aimed at understanding the aggregation kinetics and stability of this unique amyloid deposit. Future implications include using the M31 antibody as a biomarker for Alzheimer’s disease and other vascular related pathologies and to monitor the effects of treatments.

**Comparison of Islet Architecture, Beta Cell Content and Xenoantigenicity**

KT Ho-Nguyen  
**Mentor:** Jonathan Lakey

Porcine islet transplantation provides a viable alternative to Type I diabetes patients whose islets are nonfunctional due to target by the patient’s own autoimmune system. The abundance of porcine islets can be obtained from pigs killed for food every year, which makes it a more sustainable source of islet than human islets; two to three human cadavers are needed per transplantation procedure. Although several previous studies have explored the different factors that determine the success of this experimental treatment option, it is still undetermined whether the age of the porcine donors would have a bearing on the outcome of the procedure. The aim of my study was to determine the ideal donor age and weaning status of porcine donors for use in islet transplantation. To answer this question, I used specific immunohistochemistry techniques to examine islet architecture and endocrine content in porcine pancreases from four different age groups: 0–15 days old (neonatal), 16–30 days old (juvenile), 31–90 days old (young) and >90 days old (adult). Juvenile pigs showed insulin content that was comparable to that noted in adult pigs. In addition, islets examined from this age group showed high laminin content, indicating that they possessed intact basement membranes, which makes them more likely to revascularize after transplantation. They were also smaller in diameter, which would make them less susceptible to hypoxic injury immediately after transplantation. Estimation of pancreatic exocrine maturity determined that juvenile pigs demonstrated lower exocrine maturity than adult pigs. The results of this study indicate that juvenile pigs may possess characteristics that make them suitable donors for islet transplantation.

**Heterosexual and Non-Heterosexual College Students: Family Relationship Quality and Psychological Well-Being**

Long Hoang  
**Mentor:** Wendy Goldberg

Homosexuality is becoming increasingly accepted in American society. However, homosexuality may still be a stigma in the family context and may affect family relationships. This study focuses on dimensions of the parent-child relationship among college students who self-identified as gay, lesbian, or bisexual and on the students’ psychological well-being. Participants in this study were 114 undergraduate students (61.4% male, 38.6% female) who were from two West Coast universities and participated in a larger survey study. Half of the students were LGB and half were heterosexual students who had been matched on gender, ethnicity (46.8% Asian, 23.7% Caucasian, 13.5% Latina/o, 10.8% mixed ethnicity, and 4.5% other), age, socioeconomic status and generational status. All students completed an online survey about their personal characteristics, attachment orientations, depressive symptoms, life satisfaction, and self-esteem. Results of t-tests indicated that, compared to heterosexual students, LGB students reported poorer quality parent-child relationships: greater insecure attachments, poorer relationship quality, less parental support, and more instances of conflicts compared to heterosexual young adults. LGB young adults reported poorer psychological health in terms of more depressive symptoms, but there were no significant group differences in life satisfaction and self-esteem. The study suggests that young adults’ sexual orientation may be an important factor in contributing to family relationship quality and young adults’ psychological distress.

**Assessing Emotional Awareness in Social Anhedonia**

Sabaa Hoda  
**Mentor:** Elizabeth Martin

Individuals with schizophrenia show deficits in emotional processing, including awareness for emotional information. At the same time, individuals at risk for the development of schizophrenia also show difficulties in emotional processing, but previous research has not examined whether they show decreased awareness of emotions. Awareness of emotions, including attention to one’s current mood, has a number of real-world implications including social outcomes (e.g., number of friends) and functional outcomes (e.g., treatment effectiveness). The current study included two groups of...
individuals at risk for the development of schizophrenia, the Social Anhedonia (SocAnh) and the Perceptual Aberration/Magical Ideation (PerMag) group, and a healthy control group. Half of the members from each group watched a video clip intended to elicit positive mood (positive mood group), while the other half of each group watched a video clip not intended to elicit a change in mood (neutral mood group). We found that the positive mood increased for both the control and PerMag groups in the positive mood condition; the SocAnh group did not show any significant changes in positive mood in the same condition. These results indicated that SocAnh is associated with decreased awareness of emotional information, which has real-world implications for long-term outcomes.

Das Nibelungenlied: The Use of a National Myth to Justify the Dolchstoßlegende in Germany’s Interwar Years
Scott Hogan
Mentor: Kai Evers
This research looks at Germany during the years of the Weimar Republic and the rise of Nazism between the two World Wars. The research looks at how the Middle High German myth, Das Nibelungenlied, was used after Germany’s defeat in the First World War. Propaganda of the time used the myth’s hero, Siegfried, as a call to nationalism and to inspire the fallen nation. Further, both the military and right-wing politicians used the infamous murder of Siegfried (by a stab in the back) to equate it with the “stab in the back” inflicted upon the nation by elements within the country, such as the Jews, pacifists, and socialists, who were blamed for Germany’s loss of the war. Thus, the Dolchstoßlegende (the stab-in-the-back myth) came into being in 1919 and was used extensively by the Germany military and right-wing politicians. By looking at the myth itself and how Fritz Lang’s 1924 film version, Die Nibelungen, depicted the story, this research will show how the many facets of the myth were used to justify revenge taken upon those groups scapegoated for the loss of the First World War.

The Effect of Rhodiola rosea on Carbohydrate Metabolism in Drosophila melanogaster
Sean Hogan
Mentor: Mahtab Jafari
The leading causes of death in Western societies are cancer and heart disease; however, people are living longer than ever before and the record for oldest human beings is constantly being broken. By treating aging as a whole age-related disease becomes less impactful and individuals stay healthier longer. This is why we are searching for a mechanism to treat aging with the anti-aging botanical Rhodiola rosea. Aging is controlled by a number of genes and pathways and there is no one gene or pathway that will unanimously solve aging. This can be seen from research with telomerase, resveratrol, and R. rosea. The most promising solution to treat aging is a well-designed mixture of treatments that targets the minimum number of pathways. R. rosea shows promise in this sense because many of its active compounds target multiple areas to slow ageing. Currently the most effective means to increase lifespan and slow aging is through dietary restriction. However the mechanism of R. rosea is still unknown. The objective of this study is to find out if R. Rosea is working through a carbohydrate mediated pathway by using a handful of biochemical and survival assays. D. melanogaster on a low carbohydrate diet is shown to have mean lifespan 40.5 (±1.4error) and 44.9 (±1.3error) when fed R. rosea. By varying carbohydrate levels of the food being fed to D. melanogaster and supplementing with a R. rosea we have shown that R. rosea appears to be working independently of a low carbohydrate pathway.

Consumption and Fate of Natural Products in Drosophila melanogaster
Richelle Roelandt Homo
Mentor: Mahtab Jafari
Drosophila melanogaster, more commonly known as the fruit fly, shares a number of metabolic pathways and nearly 75% of its disease-causing genes with human beings. It is considered an emerging model organism in studies involving the cellular and molecular basis of aging. However, data with regards to the fate of complex drugs or natural products after fruit fly consumption is largely absent. In our pilot studies, capillary feeding (CAFE) coupled with sensitive detection analysis by electrospray ionization-ultra pressure liquid chromatography-mass spectrometry (ESI-UPLC/MS-MS) was used to analyze the presence of known catechin metabolites after fruit flies consumed green tea polyphenols. These experiments have indicated the presence of such metabolites. Upon further examination, this project could further support the use of the Drosophila Melanogaster in pharmaceutical and biomedical studies and facilitate novel drug research that aim to extend both the human lifespan and healthspan.

Campus Climate and Greeks: Beyond the Individual and towards a Structural Remedy
Wendy Hu
Mentor: Sora Han
Anti-Black incidences and performances perpetrated by Greek Letter Organizations are common occurrences across university campuses. As college campuses have grown more diverse, university resources and efforts have been focusing on campus climate issues. The usual methods of resolving these issues involve mandatory diversity workshops or programs for the offending party
to attend. This response assumes that individual anti-
Black incidents exist in a vacuum where incidences are
dealt with through an ahistorical, apolitical and asocial
framework. This study provides a structural analysis of
how Greek Letter Organizations and their continued
anti-Black performances perpetuates and protects
dominant power structures. The (re)production of
violence seen as “innocent amusements” is critiqued as a
form of symbolic violence where performing
“Blackness” is normalized as a mode of communication
necessary for the production of fraternal bonding. This
convergence of violence and pleasure embodied through
anti-Black fraternal bonding is conceptually explored as
forms of individual, community and state violence.
Based on this analysis, this study argues that Universities
must develop policies that will address the structural
exclusion of black students and faculty from processes
and positions that can meaningfully address the problem
of anti-Black racism in Greek Letter Organizations, as
well as other educational and social organizations central
to the University.

In vitro Selection of cGMP Aptamers from the
Human Genomic Pool
Carolyn Hua
Mentor: Andrej Luptak
Cyclic guanosine monophosphate, cGMP, is a molecule
derived from guanosine triphosphate via the enzyme
guanylate cyclase. Its role ranges from being a secondary
messenger in the conversion of light to electrical signals
in the eye to regulating the relaxation of smooth
muscles. Aptamers, oligonucleic acids that have specific
binding affinity for small molecules, proteins, and even
cells, have been identified through in vitro selection for a
variety of compounds. Previous studies have shown that
adenosine aptamers have been identified in a human
genomic pool, but one for cGMP has not been studied
yet. After identification of a cGMP aptamer from a
metagenomic pool, we subsequently attempted to
determine whether one for cGMP existed in the human
genome. Utilizing in vitro selection, we were able to
isolate a sequence that bound to cGMP with substantial
affinity. The sequence of these aptamers was identified
and mapped onto the human chromosome 20. We will
expand this study to test the hypothesis that the aptamer
is involved in cell signaling.

Development of a Sedation Curriculum
Catherine Hua
Mentors: Maxime Cannesson, Cameron Ricks
This study aims to identify major action items to include
in a novel sedation training curriculum for moderate
sedation providers. In the field of sedation today, there
is no standardized training or certification process for
sedation providers. Individual institutions are at liberty
to implement their own standards but hands-on training
is rarely included. Different subspecialties also have
varying focuses which leads to a range of protocols and
sedation agents used. As a result, the lack of
standardized methodologies contributes to a very
disjointed character of sedation practice. In order to
develop an effective curriculum that can be standardized
throughout multiple subspecialties, the content of the
training must have practical use and address major
corns of sedation practice today. In order to identify
these critical items, sedation experts, particularly
anesthesiologists, across the country were consulted and
asked to list necessary items to include in a moderate
sedation simulation scenario and to list goals and
objectives for simulation training. The study team used
the Delphi method to condense the results into a
consensus of approximately ten action items. Results of
the survey indicated emphasized importance on the
topics of airway management, pharmacology of sedation
and rescue drugs, patient assessment and communication.
These items were used as references in the
design of simulation scenarios for the moderate
sedation curriculum.

Are Parental Perceived Stress and Anxiety
Predictors of Postoperative Recovery in Children?
Elaine Huang
Mentor: Michelle Fortier
High levels of preoperative anxiety in both parents and
children are associated with negative postoperative
behavioral changes in children. Parental anxiety has been
found to be a predictor for higher levels of anxiety in
children in the preoperative and postoperative setting.
This study examined the effects of parental stress and
anxiety on children’s postoperative recovery at home
following outpatient surgery. Participants included 434
children aged 2 to 15 years old undergoing outpatient
tonsillectomy and adenoidectomy. Parents completed the
Perceived Stress Scale (PSS) and the State-Trait
Anxiety Inventory (STAI-T) before surgery, and the
Recovery Inventory for their children on postoperative
days one, two, three, seven, and fourteen at home. Using
Pearson product-moment correlation, parental trait
anxiety was found to be negatively associated with
children’s recovery on day 1. Chi-square analyses also
demonstrated that a lesser proportion of children with
parents who reported high anxiety were categorized as
having “good” recovery compared to children with low
anxiety parents. No significant associations were found
between parental perceived stress and children’s
postoperative recovery. Results of this study suggest that
children with high anxiety parents may exhibit poorer
postoperative recovery compared to children of low
anxiety parents. It is also possible that high anxiety
impacts parental perceptions of children’s postoperative

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recovery. Future research is needed in order to understand the relationship between parental anxiety and children’s surgical recovery to identify best methods of targeting parental anxiety in interventions in the pediatric surgical setting.

Marine Microbial Phylogenetic Diversity in the Equatorial Pacific
Jeremy Huang
Mentor: Adam Martiny

The marine cyanobacteria are an abundant and diverse family, intrinsic in global ocean cycling as primary producers. As such, it is important to identify the variability of its members across environments to better understand their potential contributions to a changing ocean. In this study, we investigate the gene content diversity of marine cyanobacteria in the Equatorial Pacific across varying depths and latitudes. Seawater samples were taken along a latitudinal nutrient gradient from Hawaii to the Equator at varying depths that included oxygen minimum zones. Microbial diversity was measured by extracting the DNA of seawater samples and sequencing an amplified portion of the RNA polymerase gene (rpoC1). High-throughput sequencing was used on the amplified rpoC1 sequences and genetic analysis of the sequences revealed the presence of several ecotypes and strains of Prochlorococcus and Synechococcus, two of the most abundant marine cyanobacteria. The distribution of these strains varied both due to depth and along a latitudinal gradient. Depth was found to be a strong factor in microbial diversity, but latitudinal changes contributed to an even greater diversification as samples reached closer to the equator.

Identifying Epitopes from Herpes Simplex Virus Type 1 Capable of Generating Protective CD8+ T Cells against Ocular Herpes
Lei Huang
Mentor: Lbachir BenMohamed

More than one billion individuals carry Herpes Simplex Virus 1 (HSV-1), a virus responsible for a wide range of diseases, ranging from painful cold sores to lethal encephalitis. A therapeutic vaccine would improve the quality of life of those undergoing herpetic symptomatic infection; however, there is currently no vaccine available. The objective of this study was to identify HSV epitopes that are capable of inducing significant proliferation of CD8+ T cells from HLA-A*02 positive and Herpes seropositive patients. In order to determine epitopes capable of generating CD8+ T cell proliferation, peripheral blood mononuclear cells (PBMCs) were labeled with carboxyfluorescein succinimidyyl ester (CFSE) and stimulated with a pool containing several peptide epitopes. Flow cytometry was used to identify CD8+ T cell populations that had undergone proliferation and narrow down which peptide pools were responsible. We found that peptide pool #2 (14 peptides) generated significant CD8+ T cell proliferation as compared to other peptide pools. Next, we deconvoluted pool #2 to narrow down individual epitopes capable of inducing in vitro proliferation of CD8+ T cells. We found that peptide #2.5, 2.8, and 2.13 showed increased proliferation of CD8+ T cells as compared to other peptides in pool #2. These identified epitopes may be used in the further development of a therapeutic vaccine against ocular herpes. These finding should guide the development of a safe and effective T-cell based herpes vaccine.

The Effect of Different BMP Concentrations on BMP Signaling and Kinetics
Grace Huynh
Mentor: Edwin Monuki

Embryonic brain development is governed by many important factors; morphogens represent one such group of factors. Morphogens are involved in determining neural cell fates through concentration gradients. Bone morphogenic proteins (BMPs), a morphogen implicated during embryonic brain development, play a crucial role in developing the border between the cerebral cortex and the telencephalic dorsal midline. While our lab and others have uncovered many facets of BMP activity in the developing cortex, the kinetics of BMP signaling in cortical progenitors have not been well studied. In this study, we investigated BMP kinetics and signaling intensities in cultured cortical progenitor cells by examining the steady state levels of phosphorylated Smads (pSmads), the immediate effectors of BMP signaling over time. We will perform protein extractions to assay for Smad activation intensities during BMP activation. We cultured and treated embryonic cortical cells with three different BMP4 concentrations (1.5, 16, and 64 ng/mL BMP4) for various amounts of time, then extracted cell proteins for quantitative Western analysis. In short-term experiments (up to one hour), we found that higher BMP4 concentration altered the time to steady-state, but had less effect on steady-state pSmad levels themselves. Similarly, in longer-term experiments (up to 48 hours), BMP4 concentration had a more profound effect on deactivation time than on pSmad steady-state levels. Our findings suggest that BMP4 concentration more profoundly regulates the kinetics of activation and deactivation rather than the steady-states themselves, which has interesting implications for how progenitor cells may interpret BMP concentration during cortical development.
Egg Cannibalism and Digestibility in the California Grunion, *Leuresthes tenuis* (Teleostei: Atherinopsidae)
Steven Huynh
*Mentors*: Alyssa Braciszewski, Donovan German

California grunion (*Leuresthes tenuis*) spawn on the beach during spring tide events. In preparation for spawning, adult grunion feed fast and have empty guts. Recently, grunion have been found with conspecific eggs in their intestines after spawning, leading to a hypothesis that their eggs provide a potential food resource. However, grunion eggs are structurally resilient, withstanding up to six developmental weeks buried in beach sand, and *in vitro* tests have failed to destroy eggs with formalin or commercial digestive enzyme preparations. We examined egg digestibility in grunion to determine if the fish can digest their eggs. Grunion were fed conspecific eggs collected from their nests, and fish were serially dissected over 10 hours. Comparisons of egg numbers, and egg visual quality showed eggs being broken down and disappearing (*i.e.* digested) during the experiment. Analysis of aminopeptidase activity showed a characteristic increase moving distally along the intestine, which correlated with a significant decrease in egg protein concentration in digested eggs. Neither carbohydrate activities in the grunion guts, nor carbohydrate concentrations of the eggs changed progressing distally in the intestine, but lipid concentrations of the eggs did decrease, matching with elevated lipase activities along the fishes’ guts. Grunion pharyngeal teeth likely contribute to egg damage, thereby allowing digestive enzymes access to egg contents for digestion. Overall, our study confirms that grunion are capable of digesting their eggs, and thus, this food resource may be important after spawning.

**Isolation, Proliferation, and Differentiation of Myofibroblasts into Adipocytes *ex vivo***

Jonwei Hwang
*Mentor*: Maksim Plikus

In humans, skin scars are characterized by being largely devoid of skin adnexa and subcutaneous fat. However, the notion that mammals cannot fully regenerate tissue has been challenged within the last few years. Previous research has shown that hair follicles form *de novo* in a large excisional back skin wound model of regeneration. Recent studies in our laboratory have shown that adipocytes also form in the wound bed, but only when in close proximity and following the formation of hair follicles. Our laboratory has used lineage-tracing and functional analyses to show that adipocytes in the wound bed derive from pre-existing myofibroblasts in the wound. We found that a signaling pathway (BMP -> Zfp423 -> Pparg) important for *in vitro* adipogenesis is also true for our *in vivo* model of fat formation in regenerating skin. This was further confirmed when a genetic ablation of BMP signaling *in vivo* resulted in reduced fat regeneration phenotype. In order to fully confirm this, we performed a rescue experiment where we collected myofibroblasts from early hairless wounds and ectopically treated them with BMP2/4. We used morphology and qPCR of WAT-specific genes to identify adipocytes. We found that both BMP2 and BMP4 induced differentiation of adipocytes while the differentiation media control did not. This is a potentially important discovery because it helps us further our understanding of molecular and epigenetic mechanism of wound healing in mammals which could potentially lead to developments for treatments and therapies for humans.

**In-situ Real-Time Sensor for Composition of Natural Gas and Renewable Biogas***

Jamie Ibrahim
*Mentor*: Vincent McDonell

This summer undergraduate research proposal is an individual project which will be carried out by the proposer. The research is associated with development of a sensor that can provide the composition of a mixture of different gases found in natural gas and renewable biogases. The work will leverage resources available at the UCI Combustion Laboratory. The research involves assembly of individual sensors which are selected based on application of physical principles relating gas composition to measurable responses. These include speed of sound, thermal conductivity, carbon dioxide, etc. The objective is to develop and assemble a prototype device that can sense the specific composition of mixtures of methane, propane, and carbon dioxide. Ultimately, the sensor can serve as a key component to a fuel flexible combustion system or for use at locations such as waste water treatment plants or landfills to continuously monitor fuel gas composition.

**Military Intervention and Humanitarian Contexts: NGOs, Ethics and the Syrian Conflict***

Mariam Iskajyan
*Mentor*: Cecelia Lynch

The human suffering and destruction in Syria since March 2011 has, above all, been a tragedy for the Syrian people. The brutal armed conflict has created a catastrophic humanitarian situation with thousands having been killed, and one of the largest cases of forced migration of people since World War II. While the armed conflict has been at the forefront of the world’s consciousness since spring of 2011, there is no common international consensus on how to, and who should, stop the violence. The depth and political complexities of the conflict have also entangled many different
interests both inside and outside of Syria. More controversially, the case of Syria has provoked an increase of discourse and debate on foreign military intervention and its various moral and ethical implications. My presentation examines the justifications for and/or against the use of force and military intervention on the part of nongovernmental humanitarian organizations that are responding to the Syrian conflict. In order to do so, I examine the views of a range of approximately 15 NGOs through analyzing public statements, position papers, and NGO websites. I find that their positions on the use of force are constructed based upon evolving moral, social, and political conditions. As a result, I argue that any determination of the use of force needs to foreground the consideration of moral and ethical principles and value systems. I ask whether or how NGOs prioritize principles such as impartiality, neutrality and respect for human dignity vs. pragmatic considerations of political and operational independence.

Cross-Strain Variation in Regulation of Beta-Glucosidase Vmax by *Neurospora discreta*
Delaney Islip  
*Mentor:* Steven Allison

The maximum reaction velocity of beta-glucosidase (BG) was analyzed when the fungus, *Neurospora discreta*, was grown on lignin and sucrose. The maximum reaction velocity, Vmax, represents the highest rate of an enzyme catalyzed reaction under substrate saturation. The progression of global warming could affect the rate of carbon degradation by fungi like *N. discreta*. As temperature increases, *N. discreta* is expected to grow at a faster rate and increase investment in the enzymes that degrade recalcitrant carbon compounds. We hypothesize that BG would show a higher Vmax when *N. discreta* grew on lignin, a recalcitrant compound, than on sucrose, a labile compound. Comparing the differences in Vmax between the two substrates will reveal the response of *N. discreta* strains. To determine the Vmax for BG, a series of enzyme assays were ran at varying substrate concentrations allowing us to calculate Vmax through the Michaelis-Menten equation. We found that certain strains of *N. discreta* displayed a higher Vmax of BG when grown on lignin, whereas other fungal strains exhibited a higher Vmax when grown on sucrose. Analyzing the data allowed us to conclude that the clear choice to specialize on one substrate versus the other was not universal and depended on the strain, therefore opposing our original hypothesis.

The Effect of Asymmetric Information on Learning Models of Color Categorization in Artificial Agent Populations
Bojun Jiao  
*Mentors:* Kimberly Jameson, Natalia Komarova, Louis Narens, Sean Tauber, Dominik Wodarz

Languages are widely shared evolving systems used for the exchange of information. Many different types of factors play significant roles in the development of such systems. Often research into shared meaning systems assume perfect information symmetry, but in reality the evolution of such systems are usual occurred in an environment with asymmetric information. In the present project I study the potential impact of information asymmetry on color categorization communication, and explore how such asymmetry influences the evolution of categorization systems between artificial agents through modification of several different variables, such as the agent population. The results of the simulation investigations: (1) reveals that the information asymmetry affects the evolution of categorization solutions on different levels, and (2) may lend significant insights to open questions concerning the best ways to model information sharing in large groups of interacting and communicating individuals.
Optical Character Recognition of Handwritten Tabular Data
Yang Jiao
Mentor: Sergio Gago, Ian Harris, Kimberly Jameson,
Optical character recognition (OCR) technology transcribes images containing typewritten or handwritten script into machine-coded formats such as a text file or spreadsheet. One of the main advantages of OCR is to reduce the overall time and human effort used for transcribing text images into editable text content. OCR has already been applied in various domains including machine translation, text transcription, and text mining. OCR research papers have been published for recognizing Latin, Chinese and Japanese characters, but research on OCR handwritten transcription is not yet sufficient. For tabular data, image features such as text region segmentation, skew correction and line detection can be major factors that influence OCR recognition accuracy. We made use of Tesseract, an existing open source OCR engine, to analyze image representations of handwritten tabular data samples from the Robert E. MacLaury color survey. We developed new methodologies for segmentation and post-processing tabular data to enhance the performance of extracting and categorizing tabular data. Our design presents an approach that overcomes two unique complexities to tabular data. The first problem is the identification of a table’s text cells (row and column) so that the results can be presented on spreadsheet corresponding to the original tabular data. The second problem is the visualization of confidence level of recognition results in color-coded format to visualize two-dimensional tables. Our research aims to develop a software tool that generates a spreadsheet containing the original tabular image with cells colored by the level of confidence for the classification of each cell.

Off-Campus vs. On-Campus Living: First Generation Students
Jazmin Jimenez
Mentor: Ana Rosas
Existing literature has studied factors that influence college completion rates without significantly explaining how students’ living conditions may impact their likelihood of completing a Bachelor’s degree. Therefore, this paper investigated whether living on-campus as opposed to off-campus impacts first generation Latino/a students’ ability to progress academically towards their Bachelors’ degree. This qualitative study addressed the issue through two study methods. For study method one, I used textual analysis to determine how the University’s resources influenced students’ decision to commute or live on-campus. For study method two, I interviewed eight first-generation Latino/a students from the community of Santa Ana, who were either living on or off-campus. The results of the textual analysis showed that online resources and pamphlets distributed by the university partly influenced students’ interest to live on-campus. The semi-structured interview findings indicated that students’ decision of where to live was influenced by their socioeconomic status and knowledge about financial aid. In addition, I discovered that those living on-campus were more likely to climb out of academic probation and progress towards graduation. These findings suggest developing programs specifically for off-campus students. They also suggest improving UCI’s resources to better inform students about ways to finance college costs. Further investigation must be done in order to facilitate Latino/as graduation and future incorporation into 21st-century skilled jobs.

Transit System Demand Model for Joshua Tree National Park
Phillip Johnson
Mentor: Stephen Ritchie
In spring quarter 2014 the UCI Institute of Transportation Engineers Student Chapter completed the Joshua Tree National Park Transit Feasibility Study, which addresses concerns regarding parking capacity and air quality associated with increased visitation over the years. An online survey and paper survey were conducted to outline the views and opinions of guests concerning the incorporation of a transit system within the park. This provides important data which can then be used to estimate transit demand and design route alternatives. This project uses visitor survey data to estimate a transit demand model for visitors to the Park. Statistically significant variables were determined, and various models were compared against each other to determine the best fit. Transit ridership was estimated following the specification of the demand model, showing the expected number of visitors using transit based on visitation numbers.

Anything but Black: A Contextual Analysis of the Afro-Cuban Experience in a Communist Regime
Sandra Johnson
Mentor: Tiffany Willoughby-Herard
Pedro Noguera’s essay “Anything But Black: Bringing Politics Back to the Study of Race” (2003) responds to the call to problematize blackness by pointing out that anti-Blackness is a global issue in which the prevailing sentiments and public opinion reflect that everyone wants to be “Anything But Black.” Scholars argue that migrant experience, class, complexion, color, folklore and jokes, and national origin shape black identities differently in many different societies across the globe. In contrast, for Noguera, many individuals and
communities do not want to face the social constraints of global anti-Blackness or their own internalized anti-blackness—resulting in suppression of the political stakes of identifying as Black. After conducting research including: ethnographic observation, fieldwork and interviews in Cuba, analyzing and researching race relations in Latin America, and examining the legal racialized immigration, I analyze the unspoken Black History of the Americas that the world has forgotten. In a communist society such as Cuba one would expect social, economic and political ideology that aims to establish a social order in which blackness does not predict disadvantaged social standing. Though Cuban political philosophy strives for this goal, in fact in Cuba racial ethnic categories are still defined as Negro/a (Black), Blanco/a (White), and Mulatto/a (Little Mule) and Black Mexican people are still belittled by social stigmas and through public naming of ethnic categories in a derogatory and allegedly comedic fashion.

**Studying Multiple Motor Protein Movement and Interaction through K560-SNAP Optimization**

*Nora Kabbara*  
*Mentor: Steven Gross*

Studying protein function is currently a forefront in biological research; the more we understand how the building blocks of life interact with each other, the closer we are to devising targeted therapies that inhibit the progression of detrimental diseases. Here, we engineered and biochemically purified a K560-SNAP, a truncated version of kinesin. Kinesin-1 is a motor protein crucial for intracellular transport, many vesicles and other cellular cargoes are transported by multiple kinesin-1 motors. Previous studies have looked at the function of single kinesin proteins, however, studying group function has been challenging. The SNAP-tags will enable us to attach to a DNA scaffold that will allow the linking of multiple motor proteins together to replicate protein transport similar to what occurs in the cell. We will study function by assembling groups of kinesins together using this DNA linkage approach, and then attaching them to beads. A first step in this procedure is to test the function of single kinesins. After purifying K560-SNAP, we will do this by checking its processivity through bead attachment and subsequent use of optical tweezers. In our first attempts, little to no movement was observed, suggesting the protein was not functional, or was not attaching to the beads. We are currently working to determine the underlying problem. As a second approach, we are investigating another protein linking method involving a protein called Spycatcher which covalently links proteins through an isopeptide linkage, and is thought to be more resilient than the K560-SNAP-tag.

**Islamaphobia, ISIS and France**

*Lora Karch*  
*Mentor: Daniel Brunstetter*

For two decades, France and Europe have experienced a heightened Islamaphobia that has affected the lives of foreign immigrants. While abroad on a fall UCEAP program in Paris I chose a topic related to my international setting and major in International Studies. This project explores diverse positions on the assimilation of Muslim immigrants with Parisian natives amidst current terrorism claimed by the Islamic State (ISIS) and past threats to Europe since the 1990s. The method of my research surrounds historical background on past terrorism, ISIS and interviews of Parisian locals both young and old in order to convey the opinions of the general public. Also included is background on the daily life of immigrant Muslims in France and its prevalence in local and international media with influence on French foreign policy. All sources and interviews conducted land into the range of fall 2014 until January 2015, with follow-up sessions conducted until towards the end of winter quarter 2015. The reaction of the natives interviewed encouraged reform within two different categories. One was the reform of regulation process of incoming Muslims and immigration laws to prevent further possible terrorism. The second was encouragement for socialism and greater integration of immigrants in everyday life. These results are a ‘fork in the road’ splitting the nation either for or against reform. This present-day rift has created consequential protests and an unavoidable “ripple effect” across many other countries in the Western world.

**Characterization of Ubiquitin-Dependent Degradation of Rad51**

*Roopkamal Kaur*  
*Mentor: Phang-Lang Chen*

Rad51 is an essential protein involved in homologous recombination. Increased levels of Rad51 have been seen in several kinds of cancers and analyzing the details of its degradation pathways can reveal potential targets for treatment. Previous study suggested that both Rad51-AL and -AE mutants, which are unable to form multimers, are unstable. Rad51 is degraded through an ubiquitination-dependent pathway and relies on the activity of ubiquitin-ligases. I found that Rad51-AL and -AE mutants are unstable, while Rad51 wild-type protein is stabilized in yeast, suggesting the presence of E2/E3 ligases in yeast. To explore how the stability of Rad51 is modulated, I expressed human Rad51 in yeast to identify the candidate E2/E3 ligases and potential lysine residues for ubiquitination. Mutation of lysine-284, 285 to arginine stabilizes human Rad51 when expressed in...
alpha factor treated, G1-arrested yeast cells. I expressed the hRad51-AE mutant in a set of yeast ligase knockout strains and identified Rad6/UBR1 as E2/E3 ligases participating in the degradation of the hRad51 protein. Our results suggest that the degradation of human Rad51 is cell cycle-regulated through Rad6/UBR1 ubiquitin ligases at the lysine residues-284, 285.

The Effect of Warming in Alaskan Boreal Forests on Plant Litter Decomposition Rates
Andrew Kavli
Mentor: Steven Allison

Human impacts on the environment are likely to have a substantial effect on ecosystem processes such as decomposition. As humans pump increasing amounts of carbon and nitrogen into the air, plant decomposition rates may be altered in response to increasing temperatures from global warming, therefore changing the amount of carbon entering the soil. We used the Michaelis-Menten model of enzyme kinetics to determine the maximum reaction velocity ($V_{max}$) for nine enzymes involved in plant litter decomposition. We determined the effect of temperature on enzyme kinetics by decomposing plant litter from black spruce trees ($Picea mariana$) in a boreal warming experiment in Delta Junction, AK. We hypothesized that as temperature increases, enzyme kinetic rates will increase as a result of more forms of carbon becoming available, therefore increasing $V_{max}$. Results showed that on average, enzymes from plant litter decomposed under higher temperatures had lower $V_{max}$ values, contrary to our expectations. This suggests that as the earth warms, microbes may adapt by reducing investment in enzyme activity, which could act as a negative feedback on carbon dioxide release from soils.

English Writing Instruction in Armenia: A Study in Yerevan and Gyumri
Carla Kekejian
Mentor: Robin Scarcella

Being one of the first Soviet Republics to gain independence, Armenia after 24 years as an independent nation is in an ongoing process of advancing and improving its various social, economic, political, and educational systems. As Armenia makes its way into the Western economy and becomes a competitor in the global market, English proficiency among its people is crucial. This international study will investigate how English writing is taught in Armenian public schools in grades five to twelve by collecting anonymous teacher survey data from English instructors. The research will be conducted in various public schools in Yerevan, Armenia’s capital, and Gyumri, the nation’s second largest city. The purpose of this exploratory, international research is to learn about the educational backgrounds and availability of English instructors in Armenia, observe the teaching resources and materials available for English instructors, and learn about how Armenia’s National Curriculum for General Education and State Standards for Secondary Education influence instruction in classroom. While the research team is still in the process of analyzing the collected survey data, we found that there exist major differences between the schools in Yerevan in comparison to Gyumri. Gyumri, being the nation’s second largest city, is highly impoverished in comparison to Yerevan, making the schools in each city, along with their teachers and resources severely different. Moreover, while the national curriculum has set nation-wide standards, it is concluded that adhering to the state standards successfully is impossible due to the nation’s socioeconomic inequality and unequal distribution of funds outside the capital.

Implementation of Sustainability Programs in Low-Income Housing Communities
Stephanie Kellogg
Mentor: Doug Houston

Green housing is usually considered a luxury for premium housing customers, but sustainability should not be considered a rich persons privilege, but rather a way of life for all of us. Furthermore, low-income residents are usually the ones who could benefit most from access to lower energy costs and access to public transportation. My research is based around trying to make environmental and social sustainability initiatives accessible to low-income housing developers by revealing which initiatives frequently offer a high return for their investment. I have done this through interviews with various participants involved with sustainable housing, and through a review of the Green Communities Criteria by Enterprise. This study has revealed that water efficiency projects, including water-efficient landscaping and up-to-date appliances, tend to have negligible initial cost and significant savings, and solar thermal water heating tends to have a very high return. A major solar panel installation, on the other hand, tends to have a very high initial investment and a very long period of return, and is often not an efficient investment unless the property is particularly energy intensive or has a very strong rebate program prepared.

“Le vice d’Asie”: The Reality and the Mythification of Opium in Britain’s Nineteenth Century
Rachel Kelly
Mentor: Jane Newman

There exists a tension at the center of opium in the British Empire between its artistic mythification and its political and economical reality—this tension shapes the construction of opium in evolution after evolution.
The Impact of Natal and Breeding Diets on Incubation Patterns and Hatching Success in Zebra Finches (Taeniopygia guttata)

Michelle Kem
Mentor: Nancy Burley

The purpose of the study was to determine how natal and breeding diets influence incubation patterns in zebra finches (Taeniopygia guttata). Due to the energetic demands of incubation, natal and breeding diets likely play a significant role in determining biparental incubation strategies. I hypothesized that zebra finches on a high-protein (HI) diet, consisting of hen’s egg and seed, will be able to allocate more time and energy towards incubation, relative to birds on a low-protein (LO) diet, consisting of seed only. By using thermal sensors and monitoring incubation and nesting behavior through observations, we were able to examine the incubation patterns of zebra finch pairs. Birds were reared on HI or LO diets and then bred for five months on a HI or LO diet in order to examine natal and breeding diet effects. Average incubation temperatures did not differ between treatments; however, there were significant differences in average time spent incubating among various diet treatments. Pairs on HI natal and HI breeding (HI/HI) diets spent the most time incubating together. Overall, HI/Hi females spent the most time incubating and HI/Hi males spent significantly less time incubating than HI/Hi females. Pairs on HI breeding diets had the greatest reproductive success. Males demonstrated more bouts of nest building compared to females; however, males on HI/Hi diets did not show more involvement in nest-building compared to males on other diets. The results of this study indicate that sex and natal and breeding diet affect how much time zebra finches allocate towards incubation.

Alternative Software: The Key to Privacy

Adam Keppler
Mentor: Ray Klefstad

Computers are now a vital part of our lives. From cell phone apps to aircraft control systems, useful and efficient software applications now influence our activities and decisions. Although computer access and hardware are now ubiquitous, programming skills and digital awareness are not. As a result, very few people are able to track or control the vast amount of data that is collected about their activities. Most of this private data is collected by major corporations, which not only profit from this data, but also sell it to others. Today, many are calling attention to the need for greater digital rights, protection, and privacy. Yet, there remains an absence of solutions. The purpose of my project is to explore alternatives for ordinary individuals to take control of their own information. My research investigates the availability of tools and techniques that are used by specialists such as virtual machines, and Buffalo routers to control access to personal data. My goal is to create a practical and simplified instruction set for these techniques to help users gain digital independence and more control over their data. As I progressed throughout this project, I discovered that most people have options for greater digital independence. However, some remained too advanced and temperamental to be used by non-specialist. I explored how users could create their own cloud, VOIP system, Virtual Private Network, Email Server, and PC Text Messaging system.

Micro-Channels for Cell-to-Cell Communication Studies

Emily Kha
Mentor: William Tang

Recently, studies have shown that there is a new method of cell-to-cell communication that may play a key role in various essential biological processes. The new discovery of tunneling nanotubes (TNTs) has led to the idea that regular cells, not just neurons, can communicate with other distant cells using long projections similar to axons. Although not as sophisticated as the axon network of neurons, more evidence has arisen to show the significance of TNTs as their presence has been found in a wide range of processes, such as development, immunity, tissue regeneration, and transmissions of electrical signals. A better understanding of this cellular mechanism would give
new insight to ways to prevent the spreading of diseases and infections in the body. However, their sensitivity to light exposure, shearing force, and chemical fixation make TNTs difficult to study in vitro. Thus, we sought to create and develop a microfluidic culture platform on which we can study the TNTs between cells within a controlled environment that can support their fragility. We used a process called photolithography with a specific mask we designed to pattern these micro-channels onto transparent glass slides. In this way, our device remains optically clear so we can observe the TNTs through a microscope and learn more about their formation and functions.

Invisible Higgs Boson Decays into Dark Matter
Zephyo Khechadoorian
Mentor: Daniel Whiteson

Despite the rapid scientific progress made in the past century, the origins of the universe remain a mystery and innate curiosity for mankind. Dark matter is one of these mysteries—its existence was proven by scientists in the early 1900s who calculated that there must be “missing” gravitational forces maintaining the current state of galactic stability. This “missing” gravity comes from “missing matter,” or dark matter, which earns its name due to its incredible lack of interaction in any field except gravity. This project was done computationally using simulated particle collisions from a previous experiment done at the European Center for Nuclear Research (CERN). Each collision, referred to as an “event,” comes with its own sets of data, such as resulting particles and energies. We narrowed down the data by eliminating events we did not need, and gathered statistics from the ones that met our criteria. In our case, the search was for Higgs bosons decaying into dark matter when produced together with a pair of top quarks. No evidence for such decays was seen, so statistical upper limits were planked on the rate at which Higgs bosons decay to dark matter. The implication here is that the Higgs boson (the particle responsible for giving mass to all matter) could also be responsible for giving mass to dark matter. In more general terms, the Higgs boson could be the link between “normal” and dark matter.

N-Glycan Branching Regulates TH17 versus iTreg Cell Fate via IL-2Rα
Phillip Khim
Mentor: Michael Demetriou

The differentiation of activated T cells into pro-inflammatory T helper 17 (TH17) or anti-inflammatory induced T regulatory (iTreg) cells is essential to immunity and self-tolerance. Transforming growth factor β (TGFβ) induces anti-autoimmune iTregs, but paradoxically also promotes pro-autoimmune TH17 cells when coupled with IL-6 and IL-23. Here, we report that N-glycan branching reciprocally determines this critical cell fate decision by regulating surface expression of the IL-2 receptor alpha subunit, CD25. Reducing N-glycan branching via genetic inhibition of the Golgi enzyme Mgat1 enhances TH17 and inhibits iTreg induction, while enhancing branching metabolically with the simple sugar N-acetylgalactosamine (GlcNAc) has the opposite effect. When combined, TGFβ, IL-6, and IL-23 synergistically reduce N-glycan branching. Under TH17-inducing conditions, enhancing N-glycan branching with GlcNAc promotes CD25 surface expression, inhibits TH17 differentiation, and induces a cell fate switch to iTreg. Thus, TH17 induction requires down regulation of CD25 surface expression by N-glycan branching. Otherwise, continued signaling via CD25 switches cell fate from TH17 to iTreg. Therefore, the ability to regulate N-glycan branching has widespread implications for the treatment of inflammatory disorders and autoimmunity.

Comparing Different Learning Models of Color Categorization in Artificial Agent Population
Katie Khuu
Mentors: Kimberly Jameson, Natalia Komarova, Louis Narens, Sean Tauber, Dominik Wodarz

Previous evolutionary models of color categorization used simple learning algorithms and population characteristics to demonstrate the pragmatic and communication conditions needed to develop and preserve a shared color categorization system. In this project, I investigate alternative learning mechanisms motivated by various learning models observed in the literature, such as reinforcement and Bayesian models. Learning models of these sorts have been widely used in many cognitive fields to represent human reasoning and learning. Operating within the structured knowledge base of the simulated world, I enable artificial agents to apply statistical inference to learn the color categories. These artificial agents engage in a discrimination game. Two color chips are randomly selected and two agents are randomly picked to determine the color terms for the chips and whether the chips are in the same color category or not. The strategy that the agent uses to select the chips is influenced by the learning style. For example, a reinforcement learner will increase the “value” of the correct category and decrease the values of the incorrect categories if the learner correctly guesses the two chips to be in the same category. I then compare my results to previous learning models. The results may provide general insights into how different learning strategies and different types of learning models influence the evolution and stabilization of categorization solutions in artificial agent populations. They may also inform us of the types of information
that are more useful to category learning and whether this also holds true for cooperative learning.

**How we can Tell what Children are Actually Learning about Language and whether it’s Crazy**

**Katie Khuu**  
*Mentor: Lisa Pearl*

Children learn much about their native language without explicit instruction. Yet what exactly are they learning in the early stages of linguistic development? One goal might be to learn knowledge that is useful for understanding the language around them, even if this knowledge is not adult-level knowledge. As a case study, I investigate how children first learn grammatical categories, like *noun* and *verb*. This process begins around twelve months, when children are capable of using: (i) distributional cues such as which words appear together, and (ii) communicative cues like what utterance types (e.g., questions, statements, or commands) words appear in. I apply a promising learning strategy using both of these cues to an age-appropriate dataset. Importantly, to evaluate whether the strategy was successful, I compare the inferred categories to adult categories like *noun* and *verb* as well as evaluate how useful the inferred categories are. My main findings are: (i) the quantitative comparison against adult categories shows that the learning strategy does not fare as well on an age-appropriate dataset as it did in the original study demonstrating its performance, but (ii) the inferred categories still seem to be useful, given qualitative analyses and information-theoretic analyses. So, in short, what children would learn with this strategy is not crazy—the knowledge is very useful, even if it is not the adult-level knowledge yet. These results can inform expectations about what typically developing children should be able to learn about language early on, and what appropriate evaluations are for assessing when they are (a)typical.

**Banking Panic and Bank Performance in the Great Depression**

**Daehwan Kim**  
*Mentor: Gary Richardson*

According to Milton Friedman and Anna Schwartz, bank failures are important because they were the mechanism through which the drastic decline in the stock of money was produced, and because the stock money plays an important role in economic developments. From 1929 to 1933, the total stock of money declined 42 percent, more than 9,000 banks failed, and commercial bank deposits decreased 42 percent. However, even during this period there were banks that did not fail and continued to operate. In this study, I will research how some banks still able to operate while others were failing. Using the data of the banks that operated in the states of Pennsylvania, Virginia, and Illinois, during the years 1933, 1934, and 1935, I will assess each state’s bank performance and look for trends to find explanations to bank failures during the Great Depression. I specifically focus on ratios including cash/deposit, loan/deposit, deposit/total liability, government securities/total assets, equity/total assets, and loan/total assets. My prediction is that banks are affected most by cash/deposit and loan/total assets. Banks are more likely to be vulnerable to bank runs if they do not have enough cash available compared to deposits; banks with insufficient cash will be unable to meet the depositors’ demands. Loans are the least liquid assets that banks hold and also have great potentials of losses. A high loan to total asset ratio would indicate that the bank has low liquidity. Data collection and analysis are currently underway.

**Overcoming Acquired Tamoxifen-Resistance through Simultaneous Delivery of Chemotherapeutic Tamoxifen and Manganese Superoxide Dismutase Silencing Agent via Acid-Responsive Core-Shell Nanoparticles**

**Jane Kim**  
*Mentor: Young Jik Kwon*

Approximately half of breast cancer patients treated with chemotherapeutic tamoxifen develop resistance to the drug. Drug resistance leading to relapse during which the patient cannot be successfully treated with the same chemotherapeutic agent is a significant problem in the clinic, and the co-administration of chemotherapeutics and an appropriate agent for silencing resistance is a possible mechanism of counteracting acquired drug resistance. This study demonstrated the successful silencing of acquired tamoxifen resistance in tamoxifen-resistant MCF7-BK-TR breast cancer cells both *in vitro* and *in vivo* through simultaneous delivery of tamoxifen and a resistance silencing agent, siRNA. The siRNA used silences a mitochondrial enzyme, manganese superoxide dismutase (MnSOD), responsible for causing tamoxifen-resistance through producing a reactive oxygen species that dismutates tamoxifen. For effective siRNA delivery, nanoparticles consisting of siRNA/PAMAM dendriplexes encapsulated within a polyketalized shell were designed to be capable of cleaving to release the encapsulated siRNA in acidic conditions associated with tumor cells. *In vitro* studies in which MCF7-BK-TR breast cancer cells were implanted in mice showed that treatment with tamoxifen and MnSOD siRNA nanoparticles caused an approximate 20% decrease in tumor weight over a seven-week period as compared to the control. The results of this study validate the concept of overcoming drug resistance using siRNA carrying nanoparticles in co-administration with the drug of interest.
Lining of Endothelial Cells and Pericytes to Improve Anastomosis between Microfluidic Channels and Perfused Capillary Networks in Cultured 3D Human Microtissues

Junghyun (Amie) Kim

Mentor: Christopher Hughes

Previous collaborative work resulted in a microfluidic platform containing 3D human microtissues with a perfused vascular network. However, attempts of FITC-Dextran perfusion have indicated a lack of anastomosis between vascular tissue units and the vessel-resembling microfluidic channels. Endothelial cells (EC) were thus lined along the channels to facilitate anastomosis throughout the system, and vascular connections were formed between the microtissue and the lined EC. The lining process was mainly composed of two parts: forming vascular networks inside tissue chambers and introducing cells into the microfluidic channel. In order to form vascular networks, a mixture of endothelial cells and fibroblasts in fibrinogen was loaded into the tissue chambers and incubated for the fibrin gel to solidify. Fluorescence-labeled endothelial cells and pericytes were then introduced into the microfluidic channel. This procedure resulted in the ECs and PCs of the outer channels adopting elongated morphologies, and invading into the tissue chamber to mimic the in vivo vascular environment.

Determination of Absolute Configuration using the Competing Enantioselective Conversion (CEC) Method: Development of an Undergraduate Laboratory Experiment and Extension of the Method to Diols

Ryan King

Mentor: Scott Rychnovsky

The determination of the absolute configuration of stereogenic centers is integral to the research of both natural product isolation scientists and synthetic organic chemists. The Rychnovsky group has developed the Competing Enantioselective Conversion (CEC) method to assist with this analysis. A major focus of this technique has been on determining chiral secondary alcohols, since this functionality is nearly ubiquitous in natural products. The CEC method involves running parallel esterification reactions equipped with either enantiomer of the acyl-transfer organocatalyst homobenzotetramisole (HBTM). Both reactions are quenched concurrently and the conversion of the alcohol starting material to the ester product in each reaction is subsequently analyzed. The absolute configuration of the alcohol is then determined, based on the reaction with higher conversion to the ester product, by comparison with a previously established mnemonic. We have incorporated the CEC method in an undergraduate laboratory experiment, where the students conducted an asymmetric reduction of a ketone and then analyzed the absolute configuration of the resulting secondary alcohol with the CEC method. We also report an extension of the CEC method to compounds containing two chiral secondary alcohols, in which the absolute configuration of both alcohols can be determined.

The Effects of Maternal Familial Autoimmunity, Gestational Stress and Autism Severity

Eline Kocharyan

Mentors: Jean Gehricke, Miryha Runnerstrom

Recent studies have shown evidence of maternal gestational immune dysfunction involved in the pathogenesis of autism. Due to lack of specificity, both maternal protective and autoantibodies access the fetus and may adversely affect fetal neurodevelopment. Psychological stress can exacerbate the effects of immune activation among mothers who have autoimmune disorders, leading to more severe autistic symptoms. Our study addressed this issue by examining differences in stress levels among mothers who had familial autoimmunity (AI), compared to those who did not (Controls). A computerized online survey was administered to 62 mothers who had autistic children aged 2-17 years-old. Stress levels during pregnancy were measured using a self-reported 4-point-likert scale, with values ranging from 1 (less than average stress levels) to 4 (much greater than average stress levels). Seventeen mothers had neither personal, nor familial autoimmunity, 21 had personal autoimmunity and 24 had family histories only. Ninety percent of participants in the AI group, who endured higher than normal stress levels during pregnancy, had a child with severe autism, compared to only 10% in controls. Within the AI group, mothers who had personal autoimmunity and experienced higher than normal stress levels during pregnancy, had significantly higher odds of having children with more severe autism symptoms. Based on our preliminary data, autism symptom severity seems to vary among children whose mothers have autoimmune and who endured elevated stress levels during pregnancy. Stress may enhance the effects of maternal autoimmunity, leading to more autism symptoms.

Are Gruesome Photos more Prejudicial than Probative?

Christian Koeu

Mentor: Elizabeth Loftus

Emotion-eliciting photographs, such as gruesome photographs, have been used in courts as probative evidence. According to Rule 403 of the Federal Rules of Evidence, the rationale for including such evidence is the claim that such evidence holds probative value exceeding...
its prejudicial value. Research has shown that mock jurors who read a trial that included emotion-eliciting photographs have yielded higher conviction rates than their counterparts who read the same trial but without the photographs. It is unknown whether jurors who are exposed to emotion-eliciting photographs are more willing to convict the defendant because of an effect of memory. The current study attempts to see how negatively-arousing photographs may bias memory towards unfavorable and erroneous information about the defendant. Participants were randomly assigned to one of four conditions in a 2x2 between-subjects design, where they saw either a neutral or a gruesome photograph, and read either strong or weak evidence against the defendant. A day after having read the trial, participants completed a memory recall questionnaire for facts presented in the trial. Participants in the gruesome photographic condition were more likely to misremember the participant as black, that the couple argued about domestic violence, and that the police found bullet casings in his car, even though none of these were ever mentioned. However, compared to participants in the neutral photographic condition, participants in the gruesome condition were more likely to be accurate when recalling information about the damage incurred on the deceased victim.

**Epidermal-Specific Gene Profiling in Rats**

*Sara Konopelski*

*Mentor: Maksim Plikus*

Organisms can regenerate to varying degrees during adulthood. While some such as the axolotl can efficiently regenerate complex tissues and organs, mammals form scar tissue in response to injury, which can often impair or even inhibit tissue and organ functionality. Intriguingly, current studies in our laboratory indicate that when mice are challenged with large excisional back skin wounds, hair follicles form de novo, a process previously thought to occur only during embryogenesis. These observations suggest that wound epidermis acquires a certain level of competence toward the hair follicle lineage and, when combined with an inductive mesenchyme, such as wound dermal myofibroblasts or dermal papillae, hair follicles are able to form in the wound. In order to study this hypothesis we isolated three types of epithelium from rats, including ventral neonate skin, adult interfollicular (IFE), and fully re-epithelialized wound epidermis to collectively compare their transcriptomes. We isolated RNA from rat epithelium and conducted Smart-seq2 to profile gene expression in each tissue type. Our initial findings indicate increase in genes important for hair follicle development in wound and neonate epidermis such as members of WNT, BMP and SHH signaling but not in IFE. Our initial findings suggest that the wound epidermis can be reprogrammed into a hair follicle fate given an inductive mesenchymal signal. Future functional hair-patch assay experiments will test and further validate this hypothesis.

**Assessing the Impact of Global News Sources on the Level of Knowledge, Attitudes and Beliefs of Ebola at the University of California, Irvine**

*Thrissia Koralek*

*Mentors: Brandon Brown, Miryha Runnerstrom*

Limited data are available on the impact that global news sources (GNS) have on college students’ knowledge of current health affairs. The goal of this study was to assess the impact that GNS have on UCI undergraduate students’ knowledge, attitudes, and beliefs of the Ebola virus. An online questionnaire was completed by a convenience sample of 514 students. The mean (M) age of participants was 20.9 (18–57). The majority of the respondents were not knowledgeable about Ebola facts, symptoms, and transmission. Knowledge scores were positively and significantly associated with GNS. Those that used official government websites as their main source of Ebola information were the most knowledgeable, followed by a combination of sources, social media, news media, and peers. Knowledge scores were higher for science majors and for those under a category of age 20 and 21. The predominant GNS used was the news media (41%), followed by social media (22%), combination of sources (21%), official government websites (12%), and peers (4%). In our study, 31% of the respondents knew that the Ebola virus is not transmitted through mosquitoes compared to 47% in a national survey in the U.S. Twenty-three participants (5%) had not heard of Ebola compared to 2% nationally. These results reveal a need for public health organizations to direct awareness efforts toward reaching college students through the news and social media.

**The Subjectivity of Dress Code Policies in Public High Schools and their Effect on Students’ Sense of Identity**

*Allison Krebs*

*Mentors: Keith Murphy, Sheila O’Rourke*

Since the first dress code law was established in the United States by the Supreme Court in 1969, there has been ongoing controversy over how schools should enforce their dress code policies. School districts have the authority to create the dress codes within their district which leads to school districts and even separate schools having varying policies. Within the schools, staff may interpret the codes differently, and have contrasting beliefs in how they should be enforced. While there is substantial information regarding the reasoning behind school dress codes, there is little information on how staff communicate with students regarding the dress codes. School districts have the authority to create the dress codes within their district which leads to school districts and even separate schools having varying policies. Within the schools, staff may interpret the codes differently, and have contrasting beliefs in how they should be enforced. While there is substantial information regarding the reasoning behind school dress codes, there is little information on how staff communicate with students regarding the dress codes. School districts have the authority to create the dress codes within their district which leads to school districts and even separate schools having varying policies. Within the schools, staff may interpret the codes differently, and have contrasting beliefs in how they should be enforced. While there is substantial information regarding the reasoning behind school dress codes, there is little information on how staff communicate with students regarding the dress codes.
codes, and then how students communicate back. The goal of this study is to examine how the possible subjectivity of the school’s dress code policies have an effect on the students’ sense of identity, and if this generates miscommunication between staff and students. Staff and students of a public high school were interviewed to research their experiences and observations with their school’s dress code. Both students and staff agreed that the dress codes specifically target female students. So while male students felt very little impact from the dress codes, the female students questioned the efficacy of how dress codes are administered, as well as many of the dress codes themselves. The subjectivity of the school’s dress code policies led many of the female students to question why showing their own skin is considered a distraction and one that is more important to deal with than being in class.

**Vivo-Morpholinos: A Potential Drug Therapy for Recurrent Ocular Herpes Simplex**

*John Krochmal*  
*Mentor: Steven Wechsler*

Recurrent ocular herpes simplex virus type 1 (HSV-1) is the leading cause of corneal blindness due to an infectious agent in the developed world. There is no cure and current treatments only decrease outbreaks. Vivo morpholinos (VM) are antisense nucleic acid analogs that can decrease expression of a targeted gene and may be promising as a potential preventative treatment. We tested the ability of a VM, designed to decrease expression of an essential HSV-1 protein ICP0, to decrease recurrent infection. Eyes of mice latently infected with HSV-1 were irradiated with UV-B to induce viral reactivation and recurrent eye disease. Unfortunately the mice treated with VM failed to receive significant protection from recurrent disease. However, we did make an interesting finding. The UV-B model of inducing HSV-1 reactivation that we used has always employed injection of serum containing HSV-1 neutralizing antibody when the mice are first infected. This increases mouse survival and helps protect against primary HSV-1 induced eye disease. We discovered that mock infected mice that received the same serum injection as a control developed significant eye disease following UV-B irradiation. To our knowledge this control had not been previously done. It is possible that the high background of disease from the serum may have confounded our ability to detect a potential effect of the VM on recurrent HSV-1 eye disease. Additional studies are needed without the use of anti-HSV-1 serum. This finding suggests that herpetic eye disease induced by UV-B irradiation may have previously been over estimated.

**Feed Me**

*Alexandra Kunesh*  
*Mentor: Litia Perta*

“Feed Me,” performs a close reading and investigation of a portion of an art book, *Jaguares y Cactus* by Ral Veroni, in order to reveal underlying political and social statements. Veroni, born in Argentina of Italian decent, has created a multitude of art books filled with poetry, fantastic imagery, and explosive colors. Particularly in *Jaguares y Cactus*, Veroni uses a unique standard of spelling to deviate from the Spanish language enough to project an alternative reading, but still function smoothly on a phonetic level. His work directly connects to the popular and strays from the institution. I examine the historic reference created by Veroni’s new standards and the pathos evoked by word choice, syntax, and translation. By dissecting sensations produced by Veroni’s word choice and comparing which to the era of publication I propose a direct relation to hunger riots in Buenos Aires. Veroni is widely known for work surrounding poverty in the city and makes reference to such experience by evoking the sensation of diaspora and hunger. To further support my claim I use an excerpt from the short novel *Schizophrenie* by Bhaun Kapil. By abstracting a close read of a similar style, I compare the two works and the pathos they use to place readers in a situation where we are forced to critique social conduct surrounding immigrant populations and the impoverished. The essay concludes with my own furthering of the poetic language of both artists to provide further critique and creative connection between the two writers.

**Decarboxylative Addition of β-Ketoacids to Alkynes**

*Sarah Kurtoic*  
*Mentor: Vy Dong*

Developing new synthetic methods can help streamline access to novel medicines and materials. With this goal in mind, we set to improve enolate allylation, a reaction commonly used in organic synthesis. We report a rhodium-catalyzed decarboxylative addition of β-ketoacids to alkynes. An allene is generated in situ to form ketone allylation products, bypassing the need for basic conditions that are traditionally used for enolate allylation. 3-oxo-3-phenylpropanoic acid was used as the model substrate and coupled with 1-phenyl-1-propyne to generate 1,3-diphenyl-4-penten-1-one with 93% yield. The highest yields are achieved with DPEPhos and the reaction proceeds at 60 °C, under mild conditions. We are currently exploring the substrate scope and searching for a stereoselective variant.
Hardiness and Social Dominance Orientation
Cherie Kwok
*Mentor: Salvatore Maddi*

Hardiness encompasses the 3Cs: control, commitment, and challenge. Commitment refers to interest in and curiosity about the surrounding world, activities, and people, and involving oneself deeply in whatever one is doing. Control is a belief that one can influence the outcome of events and direction of one’s life through effort. Challenge (not threat) is a belief that change is a normal part of life and growth, which motivates people to seek opportunities that provide wisdom and knowledge. Links between Hardiness factors and social dominance orientations have contributed to the belief that those who display Hardy personalities strive to exemplify the acceptance of new and challenging concepts, especially in the case challenging of societal hierarchies. Social Dominance Orientation (SDO) is a measure in which those with higher scores view hierarchies as necessary and present in all aspects of society. Because it measures an individual’s preference for hierarchy in a social system, SDO is typically associated with measurements of racism and general anti-egalitarianism. Research indicates that those who score highly in SDO typically display the desire to increase the difference between groups set apart through social status. These individuals may show preference towards the subjugation of low-status groups and afford higher preference towards group discrimination. The goal of this study was to examine whether hardiness scores were negatively correlated with social dominance scores. That is, if “hardy” individuals tend to be more accepting of new social concepts, experiences, and changes, and therefore are more comfortable challenging pre-existing social hierarchies. Results of this study showed, with high reliability, that Hardiness is negatively correlated with Social Dominance Orientation. These results provide support for Maddi’s theory of Hardiness, that those who display Hardy personalities are less likely to display preference for group-based discrimination and hierarchy within a social system.

Effects of Titanium Particle Radiation on the Cerebral Cortex of the Mouse Brain
Stephanie Kwok
*Mentor: Charles Limoli*

During their missions to space, astronauts are routinely exposed to galactic cosmic radiation, which consists of high atomic number and energy ions (HZE), such as (56) Fe, (48) Ti, and (28) Si nuclei. Using a mouse model, we studied the effects of low dose heavy ion radiation, similar in structure and dose to the radiation astronauts encounter in space, in the medial prefrontal cortex (mPFC), the area of the brain responsible for executive functions such as planning, decision making, and social behavior. We analyzed the effects of oxygen and titanium (5 and 30cGy) ion exposure on cognitive performance and a dance of morphometric parameters in the mPFC neurons in Thy1-EGFP (6-month old) mice six weeks following irradiation. Our findings confirm that heavy ion irradiation leads to cognitive decrement in the mPFC by causing ultrastructural decrements in dendritic architecture, spine, and synaptic density. Titanium ion irradiation impaired learning and memory responsible for discrimination between novel and familiar objects, as well as locations of objects. Reduction in spine density exhibited a positive correlation with behavioral performance indicating radiation-induced neurodegeneration during cognitive tests.

Cognitive Effects of Reduced Protein Repair Capacity in Aging Mice
Abbie La
*Mentor: Dana Aswad*

PIMT is an enzyme that repairs damaged L-isoaspartyl (isoAsp) residues in proteins. IsoAsp formation disrupts protein function and leads to severe cognitive impairment in PIMT KO (-/-) mice. PIMT HZ (+/-) mice have 50% less PIMT than WT (+/+) mice. Though indistinguishable from WTs at 4-5 weeks, HZ mice accumulate higher levels of isoAsp-damaged proteins with age, suggesting that age-related cognitive decline might be accelerated in HZ mice. We therefore compared WT and HZ mice at 6 and 16 mo of age with regard to three tests of cognitive function (Object Location Memory (OLM), Novel Object Recognition (NOR), and Elevated-plus Maze (EPM)) that measure location memory, visual memory, and anxiety, respectively. OLM performance at 6 mo was reduced in HZ vs WT mice, and the effect appeared stronger in females than males. A similar HZ deficit was seen at 16 mo, but only in the females. Surprisingly, performance appeared slightly better at 16 mo than at 6 mo in both genotypes and sexes. For NOR, a high level of variance eroded confidence in differences observed; nevertheless, the trends were interesting. Performance at 16 mo appeared markedly reduced vs 6 mo, in both sexes and genotypes. HZ vs WT differences were highly dependent on sex. In males, HZ mice performed less well than WTs at both ages. With females the HZ mice performed better than WTs at both ages. Elevated-plus Maze revealed an increase in anxiety between 6 and 16 mo, with little influence by sex or genotype.
IC 3D: A Novel Technology for High-Throughput Detection of miRNAs in Microfluidic Droplets

Louai Labanieh
Mentor: Weian Zhao

MicroRNAs are non-coding RNA molecules that are involved in the regulation of gene expression. Recently, they have emerged as biomarkers for a variety of diseases including cancer and neurological disorders. Detecting these molecules in an accurate, quantitative and selective manner in blood samples remains a major challenge due to their short lengths (18–23 nts) and low concentrations (picomolar or less). We have developed the “Integrated Comprehensive Droplet Digital Detection” (IC 3D) system as a technology that can address these challenges and quantify circulating miRNAs in clinical samples at ultra-low concentrations. In IC 3d, the unprocessed plasma sample containing the target miRNAs is encapsulated into picoliter microdroplets, enzymatically amplified under isothermal conditions and digitally quantified using a novel, high throughput 3D particle counter. Herein, we show that this system can be used to precisely quantify target miRNA directly from plasma at extremely low concentrations ranging from 50 to 10,000 copies/mL in ≤ 3 hours using Let-7a as a model target. Through the IC 3D system, we demonstrate that the target miRNA content in colon cancer patient samples is significantly higher than that in healthy donor samples. Furthermore, our assay can detect microRNAs within the same family with single nucleotide mismatch sequence specificity.

Salmonella Typhimurium Uses Manganese Dependent Enzymes to Colonize the Inflamed Gut

Diana Lam
Mentor: Manuela Raffatellu

Infection with Salmonella Typhimurium induces a host inflammatory response that causes the growth of the gut microbiota to be suppressed. A contributing factor is the expression of antimicrobial proteins, such as calprotectin, to limit the availability of essential metal micronutrients from the microbiota. Calprotectin (CP) is a zinc and manganese chelator that is upregulated during inflammation. S. Typhimurium uses manganese as an important enzymatic co-factor in the neutralization of reactive oxygen species (ROS), which is also increased in the host intestinal mucosa during Salmonella infection. We therefore hypothesize that the resistance of S. Typhimurium to CP-mediated manganese starvation permits the use of manganese-dependent enzymes involved in neutralizing ROS, thus allowing S. Typhimurium to colonize in the inflamed gut. To test this hypothesis we generated mutant strains of S. Typhimurium deficient in the expression of manganese-dependent superoxide dismutase, SodA, and the manganese-dependent catalase, KatN. In rich media supplemented with CP we found that growth of the sodA and sodA katN mutants was inhibited, a phenotype that was rescued using a CP mutant defective in manganese binding. We also separately co-infected streptomycin pre-treated mice with equal numbers of wild-type and either the sodA, katN, or sodA katN mutants. We found that the wild-type had a competitive advantage at colonizing the inflamed gut over these mutants in vivo. Collectively our data indicates that S. Typhimurium overcomes the ability of CP to enhance oxidative stress via SodA and that S. Typhimurium uses manganese-dependent mechanisms to combat oxidative stress to grow in the inflamed gut.

Synthesis of Molybdenum-99 by Szilard Chalmers Reaction

Janice Lam
Mentor: Mikael Nilsson

Commonly used for imaging and diagnostic purposes, molybdenum-99 is one of the most extensively studied radioactive isotopes in nuclear medicine. However, 96Mo only makes up 6% of the fission products from Low-Enriched Uranium (235U) irradiation in a nuclear reactor. Separation process also is difficult, time consuming, and requires high decontamination factors. In this study, molybdenum 8-hydroxyquinoline (Mo-8HQ) is synthesized in laboratory setting, and is used as the irradiation target to produce 96Mo using Szilard Chalmers chemistry. The thermal neutron reaction happens in the center of the UCI TRIGA nuclear reactor at 250kW power for one hour. Water is used as a capture matrix to separate the recoiled 96Mo atoms from the irradiation target. The results show a steady increase in 96Mo activity as irradiation time increases. Binding energy and recoil energy from prompt gamma ray are also calculated. However, there is a 10% decrease in activity near the end of the irradiation. This could be due to the breakdown of the target compound at high irradiation power. For future experiments, a slightly acidic capture matrix, or a different molybdenum target compound, such as molybdenum oxinate, could be studied to improve the specific activity of 96Mo.

Plasmodium vivax Parasitemia Clearance Levels in Internally Displaced Persons Settlements and Local Villages along the Myanmar-China Border Area

Nancy Lam
Mentor: Eugenia Lo

Chloroquine is a common drug used to treat P. vivax malaria. Concerns to increased drug resistance have been raised in Myanmar, commonly known as Burma, where transmission is intensive. Civil unrest and the establishment of internally displaced persons (IDP) settlements along the Myanmar-China border have
greatly impacted malaria transmission, contributing to the widespread usage of antimalarials. Infection on the extent of antimalarial drug resistance is valuable to use appropriate malaria treatment regime. In this study, 130 P. vivax patients from IDP and surrounding villages were followed up for parasite clearance up to 6 months from the years 2011–2013. Parasitemia levels in blood samples were identified by qPCR. We found that 4.6% of infections exhibited chloroquine resistance and relapse. Drug resistance in P. vivax infections presents an important challenge to malaria control in this region.

**Determining the Role of KCNE2 in the Pancreas**

Ann Lan  
*Mentor: Geoffrey Abbott*

While diabetic individuals often exhibit high serum glucose levels, upon fasting or aggressive glucose management they can become hypoglycemic. This, in turn, may predispose to dangerous cardiac arrhythmias, thought to underlie “Dead in Bed syndrome.” Studies in the sponsor’s laboratory recently demonstrated that genetic deletion of KCNE2, a voltage-gated potassium channel regulatory subunit, causes impaired glucose tolerance in mice. Furthermore, KCNE2 transcript was detected in the mouse pancreas, suggesting the possibility of a direct role in insulin secretion or a related process. KCNE2 may represent a genetic link between diabetes and sudden cardiac death, as it is also expressed in human (and mouse) heart and inherited KCNE2 mutations cause potentially lethal cardiac arrhythmias. Using real-time qPCR to quantify gene expression and using Western blot to analyze protein expression, we found that KCNE2 is only present in the islet cells of the pancreas. We are now conducting enzyme-linked immunosorbent assays and insulin sensitivity tests to quantify insulin response in KCNE2 KO mice and investigate how KCNE2 is involved in insulin signaling pathways.

**Psychosociocultural Factors Influencing Undergraduate Students’ Pursuit of a Graduate Degree in the Field of Dance**

Tarra Laperdon  
*Mentor: Jeanett Castellanos*

A college degree does not guarantee success or placement post graduation. Some fields facilitate greater social mobility upon degree attainment while others require experience, networking, and sometimes a graduate education. Using the psychosociocultural (PSC) framework, this study examines the psychological, social, and cultural factors that contribute to the pursuit of a graduate degree in the field of dance. For this study, the PSC model guides the examination of students’ motivation, social support, and cultural values in relation to educational pursuits. Specifically, the study explores the role of mentorship, peer support, value of degree, and perception of occupational stability. Findings highlight graduate students’ educational decision processes in the field and professionals who demonstrate occupational stability. Through interviews, both sample groups share the pros and cons to a graduate education and factors that influence their decisions to pursue a degree. Findings suggest students pursue a dance degree due to passion and the overarching goal of succeeding through their creativity. Despite emotional experiences and problems, dissenting situations, and low pay that can lead to the need for a graduate degree, dancers are also influenced to pursue a graduate degree by psychological, social, and cultural factors.

**Synthesizing Dance and Becoming a Success**

Ashley LaRosa  
*Mentors: Molly Lynch, Lisa Naugle*

After years of training and sacrifice, dancers face an outstandingly unstable career that lacks any helpful paths. So, how are concert dancers supposed to obtain a job or success in a field where there are few answers and even fewer positions? I began by researching the value of summer dance intensives and why they have become increasingly popular. I found that unlike other fields, dance companies are not only looking for who has the qualifications for the position, they are looking for specific personalities; thus, these programs provide connections and networks to meet and work with other artists for multiple weeks. I then questioned what could happen throughout the year to bridge the discontinuity between a university dance program and a professional company position. By observing professionals alongside university students at the SF Conservatory of Dance, I saw that there is a professionalism and individualism that manifests through a professional dancer the university students’ lack. However, there is also an abnormal situation where directors only hire “experienced” dancers and not qualifying university students. These two studies linked and led to my thesis question, how do dancers define success since the many years of training often lead to a poor and unpromising career? After conducting several interviews, surveys, and sociological studies, I was led to the discovery that success for a dancer is absorbed in personal fulfillment while being confident with your individualism. There are such clear roads for other majors; my goal is to start the construction of roads for dancers.

**Alterations in 5-HT1A Receptor Activity after Adolescent Nicotine and Fluoxetine Exposure**

Daryl Larry-Sar  
*Mentor: Frances Leslie*

Adolescence is a sensitive period of development between childhood and adulthood where the brain
undergoes extensive maturation and reorganization. During this time, the initiation of smoking and onset of psychiatric disorders typically occurs. Clinical evidence indicates that teen smokers are more likely to abuse other drugs and develop psychiatric disorders. Preclinical data reveals that nicotine, the main psychoactive component of tobacco, has lasting consequences on adolescent brain development and behavior. Our lab has shown that nicotine enhances behavioral sensitivity to cocaine reward in adolescent rats, an effect mimicked by endogenous activation of the 5-HT system with the antidepressant fluoxetine and blocked by pretreatment with the 5-HT₁₅ receptor antagonist WAY-100,635. The goal of this study is to determine whether adolescent nicotine or fluoxetine exposure produces long term alteration in neuronal 5-HT₁₅ receptor activity. Adolescent rats were treated by intravenous administration of saline, nicotine (60µg/kg, i.v.), or fluoxetine (1mg/kg, i.v.) for 4 consecutive days. The following day, brains were collected and processed via agonist-stimulated [³⁵S]GTPγS binding to determine 5-HT₁₅ receptor activity. Preliminary results suggest that adolescent nicotine or fluoxetine exposure may increase 5-HT₁₅ receptor activity in brain regions mediating executive function and addiction-related behaviors. These findings demonstrate long-term changes in 5-HT₁₅ receptor function that may mediate sensitization of cocaine reward after adolescent nicotine or fluoxetine exposure.

**The Gender Paradox in Homicide**

Danielle Lauber  
*Mentors: Keramet Reiter, Nicholas Scurich*

Research indicates that while more women participate in suicidal ideation and behaviors, more men commit suicide annually—creating the “gender paradox” in suicide. Although an abundant literature examines this paradox, interrogating the relationship between gender and suicide, little research examines the relationship between gender and homicide. The lack of significant research concerning homicidal ideation and gender has left a gap in homicide literature. This study sought to examine whether the gender paradox in suicide is replicated in the context of homicide. Do more women participate in homicidal behaviors and ideation, even though, statistically, more men commit homicide annually? To address this question, I conducted an anonymous online questionnaire to ask participants their beliefs and feelings about suicide and homicide, as well as to survey their homicidal and suicidal ideations and behaviors. The results did not indicate the existence of a gender paradox in homicide. However, I found statistically significant correlations between suicidal, homicidal, and aggression assessments among the subjects surveyed. The present study examines how gender influences suicidality, homicidality, and aggression, and analyzes certain characteristics of the sampled population that have statistically significant differences between genders. Better understanding of how people think and act concerning suicide and homicide will facilitate both better mental health care and better interventions to prevent untimely deaths.

**Tissue Response to Alginate Capsules in Immune Competent and Immune Deficient Mouse Models**

*Kelly Laugenour  
*Mentor: Jonathan Lakey*

Islet transplantation can drastically improve the quality of life of those suffering from Type I diabetes. Islet microencapsulation, wherein islets are coated with a biocompatible, selectively permeable polymer, has demonstrated various degrees of success in small and large animal trials. This success depends on factors including alginate purity and the location at which the devices are transplanted. This study sought to characterize the changes in microcapsule morphology and foreign body and vascular response after transplantation. Microcapsules were made with 2.5% (w/v) ultra-pure low viscosity mannnuronate (UP LVM) alginate and incubated at 37 °C in 120 mM CaCl₂ for 7±3 days before implantation into the subcutaneous and peritoneal cavity in immunocompetent CD1 mice and immunodeficient athymic nude mice for a period of 2, 6, and 12 weeks. After incubation, microcapsules showed a 14±2% decrease in diameter. However, at explant, it was noted that the same microcapsules showed significant increase in diameter which may be attributable to ionic interactions between sodium in the interstitial fluid and calcium in the capsules. Endotoxin & Microbiological analyses of UP LVM alginate was negative for endotoxin and microbial contaminants. Histological analyses of microcapsules demonstrated a mild foreign body reaction with minimal peri-capsular fibroblast growth in the subcutaneous site while those transplanted in the peritoneal cavity were free-floating and did not show any cellular infiltrate. The results of this study suggest the fortitude of UP LVM alginate microcapsules in vivo, and that the peritoneal cavity might be a preferred site for encapsulated islet transplantation.

**Vac14 Over-Expression does not Rescue FTY720-Induced Nutrient Transporter Loss**

*Samuel Law  
*Mentor: Aimee Edinger*

Cancer cells, influenced by mutated oncogenes, are reliant upon extracellular nutrients and autophagy for anabolic processes. A sphingolipid-based drug, FTY720, targets these weaknesses by down-regulating nutrient transporters (NT) such as LAT1 (large neutral amino acid transporter 1), and inhibiting autophagy by inducing
the formation of vacuoles (vacuolation) in cancer cells. FTY720 causes vacuolation by mis-localizing PIKfyve, a lipid kinase that generates signaling lipid phosphatidylinositol-3,5-bisphosphate [PI(3,5)P₂]. Over-expressing Vac14, a scaffolding protein for PIKfyve, reverses FTY720-induced vacuolation and increases cellular viability. However, the cellular interaction between nutrient transporters down-regulation and vacuolation is unknown. The purpose of this study was to evaluate if Vac14 over-expression would prevent nutrient transporter loss along with preventing vacuolation. This would elucidate the cytotoxic mechanism of FTY720 and help determine if nutrient transporter loss and vacuolation share a common pathway, as well as determining if cell viability is rescued by a combination of vacuolation and nutrient transporter loss rescue, or simply by vacuolation rescue alone. To test this, cells over-expressing vector or Vac14 were treated with FTY720 and immunostained with 4F2 heavy chain (4F2hc), a chaperone that associates with LAT1 transporters. Analysis of surface 4F2hc revealed that Vac14 over-expression did not protect cells from FTY720-induced nutrient transporter loss. This demonstrates that nutrient transporter loss and vacuolation do not share a common pathway, and that cells are rescued via vacuolation rescue alone. Further research will be focused on delineating where and how FTY720 mis-localizes PIKfyve.

**Spontaneous Calcium Transients Induced by Piezo1**

Christina Le  
**Mentor:** Francesco Tombola

A mechano-sensitive channel—Piezo1—is linked to neural stem cell differentiation, with implications for treatment of neurodegenerative diseases (Pathak et al. PNAS 2014). Piezo1 is activated by traction forces, leading to spontaneous Ca²⁺ transients in neural stem cells. We are interested in how Piezo1 affects neural stem cell differentiation, and specifically how Piezo1 generates Ca²⁺ signals that influence differentiation. The experimental goal was to determine whether spontaneous Ca²⁺ transients are generated with Piezo1 expression. Since we previously observed spontaneous Ca²⁺ transients in neural stem cells but not in Human Embryonic Kidney (HEK) cells, we asked whether overexpression of Piezo1 in HEK cells would elicit Ca²⁺ transients. After amplification and purification, the mCherry-IRES-hPiezo1 DNA plasmid was transfected into HEK cells, and Total Internal Reflection Fluorescence Microscopy (TIRFM) was used to visualize the Ca²⁺ transients. mCherry fluorescence indicated successful transfection and expression of the imaged cells. Analysis of data recorded demonstrated Ca²⁺ signals in both, non-transfected and Piezo1-transfected cells. These results are at odds with our previous experiments, which did not display Ca²⁺ transients in HEK cells, but are consistent with other researchers’ experience, reporting instances of no activity and some instances of active Piezo1 channels in these cells. For future experiments, we are considering two methods to investigate the spontaneous activity of Piezo1. One method is to use a different cell line that lacks Piezo1, confirmed through qRT-PCR. Another is to edit HEK cells with CRISPR to disrupt Piezo1 gene, thereby eliminating endogenous Piezo1 channels, and then transfet with our Piezo1 plasmid.

**Chemical Assembly of Modified *Geobacter sulfurreducens* PilA**

Tam Le  
**Mentor:** Allon Hochbaum

The anaerobic environmental bacterium *Geobacter sulfurreducens* undergoes respiration by depositing electrons on insoluble extracellular material through uniquely conductive protein filaments called pili. In order to understand how *G. sulfurreducens* pili allow for electron conduction, the primary protein which they consist of, PilA, was heterologously expressed in *Escherichia coli*. In this organism PilA is not assembled into pili, but overexpressed in the cytoplasm. This prompted exploration of how the PilA protein could be efficiently extracted and purified from *E. coli*, resulting in a unique method combining extraction with surfactants and ethanol through multiple rounds of centrifugation. PilA purity was confirmed by gel electrophoresis and mass spectrometry. This pure PilA sample inspired experiments to chemically force PilA into a filamentous structure similar to what is observed in native *G. sulfurreducens* pili. A series of buffer exchanges via dialysis and injections of metal salts led to peptide interaction between PilA monomers; however, microscopic imaging by the Hochbaum lab suggests only sparse filamentous structure formation to occur under these preliminary conditions, and current strategies for additional PilA protein filament assembly are now under refinement. Achieving such a structure could lead to scalable production of biologically-derived, electrically conductive nanowires for small devices. The polypeptide composition of this material makes varying electrical and self-assembly properties by changing the amino acid sequence of the protein an intriguing direction of future research.

**N-glycosylation Influences B Cell Co-Stimulatory Functions by Altering Intracellular Signaling Pathways**

Tram-Anh Le  
**Mentor:** Michael Demetriou

B cells, a type of antigen presenting cells (APCs), interact with CD4 T helper (Th) cells by presenting antigen
peptides, co-stimulation through CD80/CD86, and releasing polarizing cytokine. These signals are important for CD4 T_{H} cell activation and differentiation into effector cells. N-glycosylation is important for regulating immune cell function and does so by maintaining receptor surface levels and limiting their clustering. Cell surface proteins are initially modified in the endoplasmic reticulum, where Asn (N)-linked glycans (sugars) are added. Glycoproteins then transit through the Golgi apparatus, where N-acetylglucosaminyltransferase enzymes (Mgat1, Mgat2, Mgat4a/b, and Mgat5) transfer N-acetylglucosamine (GlcNAc) from UDP-GlcNAc onto N-glycan intermediates to form N-glycan branches. These branches associate with galectins to form the galectin-glycoprotein lattice on the surface of the cell. When cells are N-glycan deficient, the lattice is weakened, changing receptor surface levels and clustering, ultimately altering immune cell function. In this study, we are determining how N-glycan branching regulates B cell APC function and CD4 T_{H} cell polarization. To study this, we use inducible Mgat1 knockout mice to delete Mgat1 and prevent N-glycan branching. Our results show in vitro stimulated B cells from these mice have increased CD80 and decreased CD86 surface expression, and secrete more pro-inflammatory TNFα and less anti-inflammatory IL-10. Surface expression of activating receptors (TLR4, BCR) is also increased, and intracellular signaling towards NFκB is enhanced. Collectively, these findings suggest N-glycan branching deficient B cells promote CD4 T_{H} cell polarization into Th1 cells, thereby enhancing pro-inflammatory response. This has implications in autoimmune diseases such as multiple sclerosis where B cells are interacting with T cells as APCs, promoting TH1 mediated inflammation known to contribute to MS progression.

A Stratigraphic Analysis on Ocean Sediment Cores: Are Sediments Viable for Paleoceanography?
Gabrielle Lee
Mentors: Patrick Rafter, John Southon
The geological law of superposition argues that sediment should become older with depth—each depth recording ocean conditions at that time. However, our preliminary radiocarbon studies found that an age reversal was present in the inorganic fraction (containing foraminifera) of a sediment core from the equatorial Pacific. To address this issue, I analyzed the inorganic and organic carbon fractions of a sediment core from the eastern and western tropical Pacific that allowed me to determine that age reversals only occur in the eastern side and that the opal content of the sediment is responsible for the age offset. This shows that the method used to analyze works for areas with low opal content.

Acclimation of Substrate Affinity of β-Glucosidase in Neurospora discreta
Melinda Lee
Mentor: Steven Allison
Neurospora discreta is a decomposing fungus that acts on organic carbon compounds ranging from labile carbon compounds (C) to recalcitrant C. Labile C includes compounds that can be easily degraded, while recalcitrant C includes those that are harder to degrade. As temperatures increase from global warming, the metabolism of carbon compounds by fungi can be greatly affected. It is expected that because recalcitrant C is easier to degrade as temperature rises, microbes would specialize less on labile C and more on recalcitrant C. We hypothesize that under a warm temperature, the affinity of the extracellular enzyme, β-glucosidase (BG), for labile C would be lower than the affinity for recalcitrant C. To test this hypothesis, we studied the acclimation of the Michaelis-Menten parameter half-saturation constant, K_{m}, focusing on the activity of BG on labile sucrose and recalcitrant lignin grown under a warm temperature (22 °C) relative to the natural habitat of the fungus. We observed an overall greater average K_{m} for sucrose and a lower K_{m} for lignin. The high K_{m} seen on sucrose suggests that at a warmer temperature, BG has a lower affinity for its substrate, and thus requiring higher substrate concentrations for BG to reach its maximum velocity. Conversely, the low K_{m} seen on lignin suggests that BG has a higher affinity when the strains grow on lignin, and would reach its maximum velocity faster. These results support our hypothesis that the affinity of BG for labile C is less than that of recalcitrant C under a warm temperature.

Volunteerism among Young Adults: Impacts on the Self and Community
Peying Lee
Mentor: Jacob Avery
In the U.S., volunteerism rates are declining, with the lowest rate being among young adults. Existing research frequently addresses volunteers at the individual level, examining their motivations through psychological lens. The present study aims to further understand volunteerism in the community context, and explore the meaning and value of volunteerism in society. The study specifically investigates volunteerism through the influence of institutions—how school and family affect volunteering recruitment and retention. Through ethnographic interviews, the study draws on the perspectives and experiences of active and current volunteers between the ages of 18–25 years old. Findings reveal that defining volunteering is difficult and ambiguous, high school and college are significant places to expose individuals to volunteering, and participants
appreciate relationships created from volunteering. In order to attract and sustain volunteers, society and organizations must clearly define and value volunteering. Volunteering can influence volunteers’ moral, civic, and professional self. Requirements and expectations can take away from individuals’ duration and attributed worth of volunteering as well as call to question the impact of volunteering on the community.

**Latino Male Freshmen and their College Adjustment: A Psychosociocultural Analysis**

Andrew Leon  
*Mentor: Jeanett Castellanos*

Latina/o males are noted as the vanishing male in higher education. As higher education institutions are seeing the Browning of higher education, there is a need to understand Latino male educational adjustment and processes. Guided by the psychosociocultural framework, this study examined the psychological, social and cultural factors that impact Latino freshmen academic and social adjustment. Through a qualitative research approach, eight Latino freshmen were interviewed to understand their experiences and perspectives related to their academic and social adjustment. Findings helped to better understand the Latino freshman adjustment patterns. Specifically, unique themes that emerged in the data include: the importance of family, peer groups, and personal academic achievement. Results suggest universities must consider the importance of family and the establishment of peer groups when assisting Latino males in their college transition and adjustment. Finally, future research must be conducted on implementing programs that encourage academic moral and achievement to continue the understanding of Latino freshman college adjustment and student progress.

**High Incarceration Rates in America and Failed Sentencing Policies**

Andrew Leon  
*Mentors: Keramet Rieter, Alfonso Valdez*

The United States currently has the highest incarceration rate among all countries in the world. This research examines how the United States Sentencing Commission has contributed to these high incarceration rates. The purpose of the study is to identify governmental efforts in reforming the Sentencing Commission Sentence Guidelines and Mandatory Minimums Sentences and to examine how these efforts relate to high incarceration rates. Through observation of debates and systematic coding of transcripts, this study will examine congressional hearings and scripts on the sentencing guidelines and mandatory minimums and identify bipartisan efforts in reforming these sentencing policies. Examining these governmental documents and debates will reveal the differing political perspectives and arguments that either disapprove or support the movement to reform the guidelines. This research will also identify who the leading elected officials are within these discussions. Preliminary findings reveal that anecdotal and quantitative evidence is used within these congressional hearings to support different arguments for crime control or rehabilitative and reform efforts. Future research must be conducted to continue how to create better alternatives that the United States Sentencing Commission can implement to help resolve the growing prison population.

**Gender Mix: Insights on a Source Credibility Bias in Economic Decision-Making and Tolerance to Risk**

Pauline Lesterquy  
*Mentor: Michael McBride*

“Tokenism” literature has extensively documented that women are generally more negatively impacted by being in a minority group. The “expectation states” theory also claims that status beliefs impact interactions due to expectations about behavior and skills. Hierarchies are therefore built upon a structure of unequal relationships that reinforces beliefs about “gender status.” Studies have showed that women may be more risk-averse, especially on behalf of a group. However, not much research has been conducted on how tolerance to risk can vary with the gender of a leader, specifically depending on the context of gender mix and behaviors at the lower hierarchical level. The goal of this study is to determine whether there exists a source credibility bias in economic decision-making related to the gender of the source of information, that is, gender is examined by rational individuals as valuable information through their social beliefs and this results in some bias due to stereotypes and prejudices about women’s skills. A lab experiment aims to measure the relative credibility granted by subjects to different voices delivering the same information, according to their gender and the gender mix in the group. This helps to shed light on the power structures and beliefs that propagate gender divisions in economic occupations.

**Kinecting through Dance and Technology**

Angela Li  
*Mentor: John Crawford*

In the age of computers, smart phones, and tablets, people are finding new ways to experience life. There are apps that help you find good restaurants around the area and tablets that help you keep your notes in a small lightweight box. Technology has touched every part of our world, so how does it touch the world of dance? The goal of Kinecting through Dance and Technology is to explore the creation of dance and art when coupled with
the current technology for motion capture. Using the Kinect, Microsoft’s motion sensing device, Processing, a programming language development environment, and Active Space, John Crawford’s interactive media presentation tool, I played with new ways to enhance the artistic experience of dance by allowing automated video effects that change based on a dancer’s movement and position in space.

**Early Iron Deficiency and Cognitive Functioning at 18 Months**
Tianyu Li
*Mentor: Angela Lukowski*

Iron deficiency is the most prevalent single-nutrient disorder worldwide. Early iron deficiency has been associated with cognitive, social-emotional, and motor deficits. Our study examined associations between early iron status and infant precursors of later executive functioning with the particular goal of disentangling the influence of fetal-neonatal iron deficiency from postnatal iron deficiency on later neurocognitive outcomes. Fetal-neonatal iron status was assessed at birth using cord blood and postnatal iron status was assessed at ages 9 and 18 months. An aspect of executive functioning associated with working memory/inhibitory control was measured when infants were 18 months old. This three scrambled boxes task requires infants to search for hidden toys, constantly updating their memory for where hidden toys were found and where they remain. Analyses revealed that group differences were not apparent when considering success or failure on the task. However, for those infants who found all three toys on each of two blocks of trials, infants with fetal-neonatal iron deficiency required more trials to find the hidden toys relative to infants with postnatal iron status. In addition, infants with fetal-neonatal iron deficiency made more perseverative reaches to boxes at the same location relative to infants with postnatal iron deficiency or those who were iron sufficient; differences were not found when considering perseverative errors made to boxes of the same color. These results suggest that fetal-neonatal iron deficiency may be more responsible for later cognitive deficits relative to postnatal iron deficiency, although additional work is needed to determine if these associations are maintained over the long term.

**Understanding Ideal Positive Affect on the Prediction of Psychological Stress Responses**
Tianyu Li
*Mentor: Sarah Pressman*

Ideal affect is the emotional state that a person ideally wants to feel. A large body of research has demonstrated an association between positive affect and better health and stress outcomes. An emerging body of work suggests that meeting ideal levels of positive affect may be beneficial for physical health above and beyond levels of actual positive affect. The current study explored the extent to which wanting to feel (idealizing) high arousal positive affect (e.g., excitement) versus wanting to feel low arousal positive affect (e.g., calm) states were tied to psychological stress responses. Participants completed the affect valuation index and assessments of stress before and after two stressors: a painful cold task and a difficult star-tracing task. Results showed that Individual preferred ideal positive affect significantly differed from their respective actual positive affect. The scores of Ideal high arousal positive affect were positively associated with how long their hand remained in the cold water and negatively associated with average pain rating. Ideal affect matters in the context of acute stressors and, over time, this might lead to health benefits. Longitudinal research is needed to extend these findings.

**Investigate the Interaction of Bombesin Receptor Subtype-3 and Prostaglandin E Receptor-3 with FRET Technology**
Stephanie Lieng
*Mentor: Zhiwei Wang*

G protein-coupled receptors (GPCR) are a large family of receptors that produce cellular processes by activating signal transduction pathways inside the cell. Bombesin receptor subtype (BRS-3) is a type of GPCR that is highly expressed in human lung carcinoma cells. Studies have demonstrated that BRS-3 agonists could stimulate lung cancer growth. Prostaglandin E receptor 3 (EP3), also a GPCR, is reported to be involved in the malignant phenotype of lung cancer cells. In the presence of EP3 agonist PGE2, the receptor activates a signal transduction cascade in the cell and produces a response. However, when an antagonist is applied to BRS-3, EP3 (even in the presence of agonist PGE2) does not produce the same response. This suggests that there is a possibility that BRS-3 and EP3 interact. To investigate their interaction, I introduced the two GPCRs into human embryonic kidney cells (HEK293) via transfection. Using Fluorescence Resonance Energy Transfer (FRET) technique, we are trying to demonstration the interaction of the two GPCRs. Ultimately, the investigation of the protein interaction will unlock alternative approaches to regulate lung cancer growth by regulating the associated receptors.

**Comparison of Mainland Chinese and Chinese American Consumer Behavior**
Diana Lieu
*Mentor: Jeffrey Wasserstrom*

This study gives a comprehensive comparison of Mainland Chinese’s consumerism to Chinese American consumerism in regards to luxury goods. Globalization and socioeconomic factors have led to a rise in the
middle class in China in which more people can afford to live a luxurious lifestyle. As for America, the increase of Chinese tourism, Chinese exchange students, and Chinese workers in America has led to a similar increase in the consumption of luxury goods in America. Asian Americans are also becoming the largest minority consumers of luxury goods in America and Chinese Americans make up a large percentage of these consumers. Thus this study gives insight into not only Mainland Chinese’s consumerism in America, but also whether Chinese Americans exhibit the same consumer behaviors as Mainland Chinese or whether Chinese Americans exhibit their own unique consumer behaviors. The results from this study draw from in-depth interviews with young Mainland Chinese and second generation Chinese Americans living in America. The hypothesis is that differences in cultural ideology, as well as other factors contribute to the differing perspectives towards luxury goods between Mainland Chinese and Chinese Americans. Mainland Chinese and Chinese Americans were have different a notion of what a luxury good is but exhibit, to a certain degree, similar opinions to the social status associated with owning luxury goods.

**College Students’ Perceptions on their Future Household Division of Labor**

Allison Lim  
*Mentor:* Judith Treas  

This project looks into college students’ perceptions on gender roles regarding how household and childcare labor should be divided in their future families. There has been significant research on the division of household labor in families and studies have shown that women are overwhelmingly responsible for the majority of unpaid work within the family, even in dual-career households where both partners work full time for pay. In addition, research shows that women are the ones who are typically expected to shift from working full time to working part time after having children. However, not much research currently exists on perceptions that the college-age generation has regarding gender roles, especially considering the recent third wave of feminism concerning equal rights for women. The goal of this study is to research if there are any changing ideologies among college-age participants regarding gendered housework tasks which will either demonstrate a greater move towards gender equality or no change compared to current research regarding the perceptions of gender roles in the household. I have not yet completed collecting my data but, so far, information from surveys and interviews has shown an interesting trend that women appear to hold more traditional views than men regarding gender roles in the household. My data shows that women express a preference towards traditionally “feminine” tasks. On the other hand, trends among male participants have shown that they appear to hold more egalitarian views, without specific preferences towards certain chores including those that are considered traditionally feminine.

**A Quantitative Comparison of the Genetic Toggle Switch**

Benson Lim  
*Mentors:* Elizabeth Read, Mahua Roy  

Computational models of complex biochemical networks can be useful in understanding the regulation of gene expression. One important consideration in developing such models is how to include the effects of noise, because gene expression has been demonstrated to be stochastic. We use the Langevin equation to accurately model the dynamics of the system while taking into account an added noise. By increasing the noise or the diffusion in the system, the shape of the steady state distribution of protein changes.

**Child and Parental Factors in Complementary and Alternative Medicine Use**

Paulina Lim  
*Mentor:* Michelle Fortier  

The present study examined both child and parent factors, including parental perceptions of children’s pain and child temperament, associated with frequency of Complementary and Alternative (CAM) use in children with chronic illness. Parents of children ages 2–18 with chronic illness (N = 149) from CHOC Children’s Hospital completed the Parental Pain Expression Perceptions (PPEP), Emotionality, Activity, and Sociability Temperament Survey (EAS-TS), and frequency of use from a list of 27 CAM therapies. Negative binomial regression was used to examine the effect of pain perception (PPEP) and temperament (EAS-TS) on number of CAM therapies used. Results showed that parental misconceptions about active or loud pain expression in children predicted the number of CAM therapies used, such that parents who reported more misconceptions about children’s pain expression (e.g., that children always express pain through whining or crying) used more CAM therapies than did parents who reported fewer misconceptions. Results of the current investigation suggest parents who endorse more misconceptions about loud or active pain expressions may be more likely to use CAM therapies for children than do parents with fewer misconceptions about pain expressions. Parental misconceptions of children’s pain expression have been associated with giving fewer analgesics to children; therefore, it may be that parents who report these misconceptions are more likely to seek out non-pharmacological means of treating children’s pain.
Progress toward Efficient Synthesis of Vinyl Chlorides
Beradette Lingat
*Mentor:* Kenneth Shea

Vinyl chlorides are significant as key functional groups in natural products as well as in their ability to act as cross-coupling agents for creating new carbon-carbon bonds. The preparation of vinyl chlorides in one step from ketones can be challenging, but we have discovered that molybdenum pentachloride exhibits similar reactivity to the known reagent tungsten hexachloride. Substrates such as 4-phenyl-2-butanone, tert-butyl cyclohexanone, propiophenone, and deoxybenzoin were used to introduce different functional groups and test the selectivity of both the tungsten and molybdenum reagents. By subjecting the substrates to the tungsten and molybdenum reagents under varying reaction conditions, we were able to produce vinyl chlorides as well as gain some understanding of the mechanism involved in the production of vinyl chlorides from tungsten hexachloride and molybdenum pentachloride. Through inspection by H1 NMR and C13 NMR, we were able to conclude that the vinyl chloride can be selectively generated from substrates such as deoxybenzoin where the installation of the vinyl group produces a conjugated pi system.

Physiological and Stoichiometric Changes of *Escherichia coli* Adapted to High Temperature
Krista Linzner
*Mentor:* Adam Martiny

Previous studies have shown that *E. coli* exhibits shifts in stoichiometry in response to short term temperature increases, due to varying growth rate, biochemical reactions and protein degradation. In my experiment, I attempted to answer the question of how cellular stoichiometry and physiology would change in cell lines that had been adapted to high temperature long term compared to the ancestral line they were evolved from. The cell lines I used have been adapted for 500 generations at a temperature of 42.2 °C and display a large range of genetic mutations, the most frequent of which are the rpoB and rho genes. I grew the *E. coli* in a modified Davies-Mingioli media adjusted to have lower phosphate levels and constructed growth curves using flow cytometry. I then filtered liquid cultures for particulate organic phosphate, particulate organic nitrogen and particulate organic carbon assays while cells were in exponential phase. I found that growth curves varied among cell lines and that modifying phosphate levels in the media affected growth.

The Roles of Memory and Knowledge in Generating “Top 10” Lists
Emily Liu
*Mentor:* Michael Lee

A majority of previous literature focuses on how people express knowledge or how people recall information. For our study, we consider the interaction between the two by studying the role that memory and knowledge play in the accuracy of people’s generation of “Top 10” lists. Inaccuracy could be due to either a lack of knowledge or a temporary failure of memory and we aim to see how people’s memory for serial order varies across different states of basic knowledge. We report data from an experiment in which people gave lists for questions like “list the top 10 most watched TV shows in the US,” with and without the help of a memory aid that provided an alphabetical ordering of the true top 50 answers. We study the changes in accuracy resulting from the availability of the memory aid, the patterns with which people modify their lists when the aid is provided, and the stability of individual differences in these memory and decision-making processes. We find clear converging evidence that, for some lists, involving large number of potentially relevant items as measured by their type-to-token ratio, memory plays a central role in determining the accuracy of the list. There are implications of these findings for extending models of serial recall to non-temporal criteria, and the development of models for aggregating human knowledge of rankings.

The Implications of the Economy and Cultural Beliefs on the Proliferation of Democracy
Nelson Liu
*Mentor:* Russell Dalton

The late 20th and early 21st centuries experienced many extraordinary political changes and turmoil, usually involving democratic fervor. Numerous theoretical hypotheses attempt to explain how regimes have or have not made a transition to a democracy, including economic, cultural, and socio-economic modernization theories. The main purpose of my research is to determine the implications of a country’s economy and cultural beliefs in determining if a country can successfully democratize. In order to cover as much ground as possible, this study looks at four countries with varying economic conditions, cultural backgrounds, as well as political situations: Singapore, India, Egypt, and the German Democratic Republic (East Germany). The study shows that meeting certain economic standards is not sufficient for a country to become democratic. Furthermore, a country’s traditional sociopolitical culture is not a hindrance to the proliferation of democracy. This shows that democracy...
is not an exclusive political system that only certain countries are privileged to have. What this then implies is that the desire for democracy, and ultimately freedom, is an innate universal value desired by all. With this knowledge, there can be a stronger endeavor among democratic states to introduce democracy to places that were previously thought impossible.

**Microfiber Contact Resistance Characterization**

Qihao Liu  
*Mentor: Yun Wang*

Microfiber refers to synthetic fibers finer than one or 1.3 denier or decitex/thread. There are some outstanding characteristics of microfiber such as exceptional strength, improved breathability, lighter weight and durability. Because of microfiber’s properties, it has been used in many industries such as apparel, clothing, insulation, and environmental issues. There are still unknown characteristics of microfiber, for example electrical properties, that may be applied in the industry. My research focuses on the contact resistance of two microfibers when they are overlapped in different angles. For comparison, I will also test wires that are made of different materials and in different sizes. To begin with the research, a stationary holder will be fabricated to fix two wires together. Once the wires are fixed, I will adjust the angles between two wires, and also apply different weights on the top as the research variables. The end of wires will be connected to a measurement device, first a multimeter, then later a Multi-Channel potentiostat. The resistance value increases when angle gets bigger, and it gets smaller when the weight increases. Wires including microfiber and regular copper will deform when there is stress applied to them, and the contact surface will change accordingly. However, the change of the resistance is slight, and this property can be used in electric sensitive products such as fuse, and sensor.

**Complementary Food Systems: Resolving the Local vs. Modern Agricultural Dichotomy**

Stella Liu  
*Mentor: Richard Matthew*

Over the past years, the alternative local food system and modern agriculture system have evolved into a dichotomy. The two have become framed as opposing paradigms with only one solution for the future. This research reveals the limitations of this either-or framework by arguing that the framing has negative implications on food policy, infrastructure, and the future of food security. To understand the origins of this dichotomy, this research turns to history. A broad historical timeline of each food system reveals how the terminologies “local” and “modern”/“industrial” agriculture are embedded within larger societal processes of industrialization and globalization. In addition, this timeline demonstrates how the two systems co-evolved together. A new holistic framework is proposed in this research paper that reflects this past, providing a more accurate terminology for the present, and lays a foundation for a sustainable, efficient, and innovative future: complementary food systems. The complementary systems framework, combining elements in a way that enhances or emphasizes the qualities of the other, has revolutionized health care. Parallels between healthcare and food are drawn to argue for an extension of this framework to the food system. Such a new framework can create more direct and comprehensive food policies, provide a unified goal for systems to work toward, and create a new foundation that accounts for innovative forms between the two extremes.

**A Comparison of Humanitarian Intervention: Haiti vs. Japan**

Sunny Liu  
*Mentors: Brandon Brown, Terry Schmidt*

The climate of emergency humanitarian response differs from country to country. This study looks at the 2010 Haiti earthquake in comparison to the 2011 Japanese earthquake in order to understand the political, socio-economic and cultural factors that influence the effectiveness of foreign and internal disaster response. Although the two earthquakes were comparable in magnitudes and sizes of the destruction, internal and international responses, as well as the outcomes of disaster relief differed greatly. The internal response in Haiti, characterized by disorder and inadequacies, revealed political and economic instability of the country. In Japan, challenges emerged along complications after the nuclear plant leak. Literature review is used to generate a comparison between the two countries’ historical, political, socio-economic and cultural background, as well as their relationships with the international community. Data from the United Nations, World Health Organization and the countries’ health ministries are used to examine the successes and challenges identified during these two cases of emergency responses. Furthermore, a selection of periodical journals and media clips are used to assess the internal as well as external reaction to the emergency response. Criticisms of poor management among relevant services, proximity, and human resources are common themes in both natural disaster responses. This study aims to better understand the strengths and what is lacking in emergency humanitarian response. Governmental actors, medical teams, and foreign aid communities can take the collective lessons from these experiences and use them to create a more effective response to emergencies.
Role of Melanin Concentrating Hormone in the Estrous Cycle
Kevin Lo  
Mentor: Olivier Civelli

Melanin Concentrating Hormone (MCH) is a neuropeptide that acts directly on the MCH 1 receptor, and MCH1R activation has been shown to regulate various responses related to energy homeostasis, reproduction, sleep/wake cycle, and reward. MCH is expressed in only two brain nuclei, the lateral hypothalamus and zona incerta. In general, MCH release increases food intake and regulates energy expenditure. The actions of MCH appear to be modulated by fluctuations in ovarian hormones. Estradiol, which plays a role in regulating the estrous cycle, has also been found to decrease the orexigenic actions of MCH in mice. Furthermore, MCH infusions into the medial preoptic area induce luteinizing hormone release and facilitate sexual receptivity in estradiol primed female rodents. Based on these previous findings, the MCH system may be involved in regulating estrous cyclicity. We hypothesize that disrupting the MCH system will interrupt normal estrous cyclicity in female mice. To test this hypothesis, transgenic mice that have been bred to allow for the ablation of MCH neurons were used. Daily vaginal smears before and after the MCH neuron ablation treatment were collected and analyzed to determine the estrous stages of these mice. The results obtained from this experiment could have important implications for women’s health, since many pharmaceutical companies have designed drugs that antagonize the MCH system for its role in weight loss.

Wide-Ranging Patterns in Synechococcus Stoichiometry over a Diel Period
Johann Lopez  
Mentor: Adam Martiny

The photosynthetic cyanobacterium, *Synechococcus*, is one of the most widely distributed phytoplankton in marine environments. Constituting an estimated 16.5% of ocean net primary production, this species plays an enormous role in the cycling of both nutrients and carbon within the earth system. As with nearly all other phytoplankton, however, the elemental composition (AKA stoichiometry) of *Synechococcus* is widely assumed to be fixed in model estimates of global primary production and other key biogeochemical processes. Much work has shown that the ratios of carbon to nitrogen to phosphorus (C:N:P) can vary significantly between phytoplankton species and environmental regime, but it is still unclear how widely the elemental composition of single cells can vary over a daily cycle (as driven by light availability). This study tracked the cycle of C:N:P in chemostatic cultures of *Synechococcus* over two 24-hour periods. Four cultures were grown under identical conditions at four dilution (growth) rates, and sampling occurred every three hours for measurement of cellular carbon, nitrogen, and phosphorus. In addition to substantial variability between growth rates, large patterns consistent across growth rates were shown in cellular carbon as well as carbon to nitrogen and phosphorus ratios. Significant accumulation and subsequent respiration of carbon was observed over each 24-hour period, conferring much larger deviations from fixed stoichiometry than previously believed. The consequences of these results concern the path of carbon/nutrient cycling, the interactions within marine ecosystems, and ultimately the capacity of Earth’s oceans to serve as a carbon reservoir.

Temporal Variability in Elemental Composition of Particulate Organic Matter along the Southern California Coast
Michael Louie  
Mentor: Adam Martiny

Water replacement occurs along the Southern California coast due to strong winds blowing perpendicular to the coastline causing deep sea water to displace surface water. This unique phenomenon is called upwelling and results in the increase in cold and nutrient-rich water at the surface. These nutrients are used by the phytoplankton, which grow faster after an episode of upwelling. Phytoplankton are an important field of study as they are one of the main primary producers in the ocean and influence biogeochemical cycles. Stoichiometry of particulate organic matter (carbon – POC, nitrogen – PON and phosphorus – POP) is predicted to be near Redfield proportions: C(106):N(16):P(1) as has been observed in other upwelling regions. In upwelling regions, phytoplankton uptake of nutrients vary depending on abiotic factors (like light or temperature) changing throughout seasons and directly influencing phytoplankton productivity. By measuring the concentrations of (POC), N, and P, as well as nutrients concentrations at Newport Pier, we were able to look for changes in the elemental ratios overtime. Through changes in upwelling and factors affecting phytoplankton uptake, we have found that particulate C:N:P ratio actually varies over seasonal periods. And after 3 years of sampling we found a mean ratio is 107:15:1, which shows a strong similarity to the Redfield ratio.

Defining the Role of CDC6 in MDA-MB-468 Breast Cancer Cells
Matthew Low  
Mentor: Peter Kaiser

Previous research has shown the vast majority of cancer cells have a particular metabolic requirement for
methionine. In contrast to non-transformed cells, cancer cells are unable to proliferate in growth media where methionine has been replaced with its metabolic precursor, homocysteine. This unique requirement for methionine has been described as the “methionine dependency of cancer.” Interestingly, cancer cell proliferation during methionine stress can be rescued by S-adenosylmethionine (SAM) supplementation. To understand how SAM levels are connected to the methionine dependency phenotype in cancer, SAM sensitive factors previously observed in yeast were investigated in the mammalian system. Specifically, pre-replication complex (pre-RC) instability was observed in both systems and may be the leading cause of defective proliferation. The G1 expressed replication factor Cdc6 is one factor responsible for forming the pre-RC through the recruitment of mini chromosome maintenance (Mcm) proteins onto DNA. During methionine stress, both Mcm and Cdc6 proteins lose association with chromatin. Interestingly, the decrease in association correlates with decreased levels in total Cdc6 protein, whereas, Mcm protein levels remain constant. To identify the role of Cdc6 during methionine stress, we have created a Cdc6 inducible system in MDA-MB-468 breast cancer cells to determine if overexpression of Cdc6 is sufficient to overcome the methionine dependency phenotype.

**Benzo[a]pyrene Increases Germ Cell Apoptosis in the Mouse Fetal Testis**

Muzi Lu  
*Mentor:* Ulrike Luderer

Benzo[a]pyrene (BaP), a potent carcinogenic polycyclic aromatic hydrocarbon (PAH), is an environmental toxicant found in cigarette smoke, air pollution, and grilled foods. Reactive metabolites and reactive oxygen species produced during PAH metabolism induce testicular toxicity and lead to decreased fertility. However, the biological mechanism of BaP-induced germ cell death in the mouse testis remains unclear. Our prior *in vivo* study showed that testes are susceptible to PAH toxicity during fetal development. We hypothesized that fetal BaP exposure triggers the activation of caspase-3 and initiates apoptotic cell death of testicular germ cells. Fetal testes from C57BL/6J dams were dissected out at gestational day 13.5 and either fixed immediately or cultured for 6 or 24 hours in media supplemented with 0.005% dimethyl sulfoxide vehicle (DMSO) or with various concentrations of BaP d (50, 500, or 1000 ng/mL). Germ cell apoptosis at 6h and 24hr was measured by activated caspase-3 immunostaining. BaP exposure did not increase apoptosis in a concentration-dependent manner in the fetal testis at both 6h and 24h time points. However, the 50 ng/mL BaP group differed significantly from the DMSO control. These results show that BaP treatment increases apoptosis in male germ cells at the lowest BaP concentration tested in this study, indicating that a relatively low concentration of BaP disrupts germ cell development in the fetal mouse testis.

**A Study of Luminance in Feature Based Attention**

Vivian Lu  
*Mentor:* Charles Wright

Visual attention is an important cognitive mechanism that allows a person to focus on a subset of information in a scene, based on their goals. If a person wishes to attend to a subset of the visually available objects, they could rely on feature-based attention. This attentional mechanism in particular allows one to attend to items with a certain target feature (*i.e.* a specific color or orientation) in a scene even when distractor items are present. In this experiment, participants viewed a display of dots randomly scattered on a grey background that varied in luminance (*i.e.* different levels of grey ranging from black to white) and they were asked to indicate the center of the target dots while ignoring the distractor dots. The purpose of the experiment was to observe the individual differences between young adults in their ability to deploy feature-based attention in order to complete the tasks. We have completed data collection and are in the process of analyzing the data. In the future, we plan to compare the results from these participants to results from older adults. According to other studies, a person’s ability to deploy feature-based attention worsens as they age. Participants’ performance in the task may serve as a useful measure for cognitive aging, as we expect older participants to make more errors than younger participants.

**Upregulation of Chondroitin Sulfate Proteoglycans in Chronic Nerve Compression Injury**

Michele Lu  
*Mentor:* Ranjan Gupta

Chronic nerve compression (CNC) injuries, such as carpal tunnel syndrome, often result in poor outcomes even after optimal medical management. To address this issue, we investigated the contribution of chondroitin sulfate proteoglycans (CSPGs) to scar formation following CNC injury. Using previously validated animal models we created CNC injuries on mouse and rat sciatic nerves and characterized the CSPGs present at time points known to correlate with myelin disruption and remyelination. Specifically, we examined scar formation at 2 and 6 weeks after injury in mice and at 4 and 6 months after injury in rats. In mouse models, decorin protein increases 1.50-fold at 6 weeks after CNC creation and is localized to the epineurium and perineurium of the compressed nerve. Profiling of aggregcan, brevican, decorin, NG2, phosphacan, and

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versican in compressed rat sciatic nerves over a period of 24 weeks shows a bimodal increase in aggrecan mRNA expression. Aggrecan mRNA initially exhibits a 23.3-fold increase compared to non-compressed control samples 2 weeks post-CNC creation, then drops to 5.14-fold and then increases again to 16.4 ± 6.91-fold at 20 weeks post-compression. Aggrecan protein is also upregulated 40.9-fold at 4 months and 17.8-fold at 6 months. In addition, versican mRNA is upregulated 1.46-fold in 3 month compressed nerves. Taken together, the data serve to characterize the contribution of CSPGs in intraneural scar following CNC injury and demonstrate a potential role for chondroitinase treatment as a promising new avenue of treatment for CNC injuries.

Are Ethnic Identity, Ethnic Socialization, and Perceived Parental Prejudice Associated with Young Adults’ Dating Preferences?
Madison Maas
Mentor: Wendy Goldberg

With increases in immigration, there has also been a rise in interracial romantic relationships and increased research interest in young adults’ decisions to enter into an interracial/interethnic relationship. This study focused on three specific factors: ethnic identity, ethnic socialization, and perceived parental prejudice that were hypothesized to be associated with college students’ ingroup or outgroup dating preferences. Ingroup refers to individuals sharing the same race/ethnicity as the participant. In addition, ethnic identity was tested as a possible mediator between: (1) ethnic socialization and dating preferences, and (2) perceived parental prejudice and dating preferences. Participants were 628 college-aged students from two west coast universities. Through an online survey, students responded to questions about their ethnic socialization during childhood, the strength of their ethnic identity, perceptions of their parents' prejudiced attitudes toward outgroups, and their ingroup/outgroup dating preferences. Results of ANOVA analyses indicated that college students who preferred to date only ingroup members had significantly higher levels of ethnic identity and perceived parental prejudice than those who included at least one outgroup member in their top three dating preferences. However, ethnic socialization did not differ by dating preferences. These findings suggest that parental and ethnic socialization during childhood may play a significant role in an individual’s attitudes of other cultural groups and their later preferences concerning ingroup/outgroup dating.

Dance Therapy and Education in Israel
Juliette Mackey
Mentor: Lisa Naugle

In my research I interviewed the General Director Prof. Danny Brom of the Jerusalem Center for the Treatment of Psychotrauma and danced with Idan Cohen, Noah Wertheim and Batsheva dancers to greater understand how dance operates in the therapeutic and concert realms of the Middle East. I will give a brief presentation on the art therapy programs implemented in Southern Israel, for children who have experienced consistent stress. Also there are various forms of art therapy available to returning soldiers. Which, since all citizens serve time in their military, many of the arts reflect their experiences as a society, revealing the loss and communal strength that comes with their service and role as a citizen of a country in conflict. To explore the dance culture of this region, I will also demonstrate some of the dance release techniques and ways of forming choreography with dancers that I learned at the Jerusalem Academy of Music and Dance. Katie Summers and Emily Hoff will help me show some of the choreographic processes and techniques that I learned while abroad, as I explain them. I have found this to be the easiest way to convey the ideals and focuses of these types of topics to my peers who aren’t involved in dance and believe that this presentation style will be the most effective this new audience. Sheron Wray used movement in conjunction with speech in her TED talk in 2011. This presentation will merge concert dance and education in ways that I hope to continue in my studies.

Combination of Hybrid Column and Core Bracing Systems as Structural Lateral Force Resisting System
Francisco Magallon
Mentor: Farzin Zareian

The investigative strategy for the dual structural system involved the use of finite element method analysis software designed for buildings (CSI’s SAP2000). Ground motion accelerogram records of historical earthquakes were entered for multiple time history analyses. Performance-based design ensued with the informed trial and error placement of bracing throughout the entire core of the structure and partially the outermost frame of the structure. The design resulted in a stiff structure which did not dissipate much energy through deflection but instead transferred all of the forces to the base columns. Even under the sine wave, the structure did not fail because of how many base reactions provided by the hybrid columns (each of which consists of four actual columns). The combined load capacity of the 81 columns was sufficient for
withstanding the shear and uplift forces developed by each ground motion on the shake-table. The balsa wood model performed well, but a full scale steel frame structure of the same design would have been unreasonably costly because of the tonnage of steel required and peak roof accelerations experienced under the influence of ground motions. The performance of the balsa wood model also does not translate directly to that of a full scale structure because of the significant difference in material properties.

Characterization of the Functional Role of a Newly Evolved Gene Participating in Sperm Competitive Ability in Drosophila melanogaster
Robert Magie  
Mentor: Jose Ranz

The functional analysis of species-specific genes is in its infancy. The Sperm dynein intermediate chain (Sdic) gene cluster is found only in Drosophila melanogaster. Sdic was formed by the local duplication of two other genes that underwent multiple deletions and tandem duplication events. One of the Sdic copies was shown to encode a protein present in the tails of maturing sperm, which plays a role in sperm competitiveness. Thus, females that mate with two males, one carrying Sdic and another lacking the gene, give rise to a higher proportion of offspring coming from the first type of male. One possibility is that the lack of the Sdic protein compromises the maneuvering of the sperm through the female reproductive tract on its way to the egg. In order to test this effect, a synthetic strain of flies that expresses green fluorescent protein present in the tails of maturing sperm, which is isolated, and the sperm in different parts (sperm receptacle, spermatheca, and uterus) counted under a fluorescent microscope. Differences in sperm distribution can shed light on the relevance of the SDIC protein in the context of sperm dynamics in the female reproductive tract, which will be discussed.

Somalia and Rwanda: Civil Conflict, the Environment, and Cycles of Instability
Judy Mak  
Mentor: Richard Matthew

Somalia and Rwanda have much in common: they are two East African countries with promising opportunities for economic and sociopolitical growth, despite their unstable histories; they both rely heavily on their agricultural and/or pastoral sectors; they both have mixed relationships with the media and international intervention; and most prominently, they both have undergone extensive civil conflict since 1990 that has resulted in the mass displacement of peoples, even if many aspects of their respective conflicts differ. With each of these countries, environmental degradation and civil conflict has had a mixed relationship. While case studies of this relationship have been discussed extensively in past papers, few have used a technology that has also risen to prominence since 1990: satellite imaging. In this case, an analysis of remote sensing images specifically suggests that in Somalia, vegetative levels decreased during the study period of 2006–2014 with, but also even in spite of, a major drought in 2011–2012, and in Rwanda, the events of 1994 resulted in a significant decrease in vegetative levels. More analysis may be performed to determine how closely this correlates with anthropogenic—and specifically, conflict-based—disturbance of the physical environment.

Automatic Segmentation of Coronary Arteries using Hessian-Based Multi-Scale Filtering and Eigenvectors to Track Vessels
Shant Malkasian  
Mentors: Sabee Molloi, Benjamin Ziemer

Using diagnostics like Fractional Flow Reserve (FFR) or blood perfusion have become gold standards in identifying coronary artery disease, the leading cause of death in the United States. As medical imaging has improved, it is now becoming possible to calculate these diagnostics, using only a Computed Tomography Angiography (CTA), an X-ray scan that images a patient’s heart in three dimensions. To calculate FFR and myocardial perfusion from a CTA, it is necessary to segment the coronary arteries out of the CTA image. A method of coronary artery segmentation has been developed that will utilize a number of specially designed filters, including a Hessian-based multi-scale filter, in order to yield a three dimensional image of only the coronary arteries. This image can then be used by array of other diagnostics, like CTA FFR and CTA myocardial perfusion. I found that CTA images required many steps of processing, prior to applying the multi-scale filter, in order to properly work. While the current results are promising, there is still much more work to be done in refining the methods developed this fall. Improvements in implementing this method of segmentation have been made both in the Hessian-based multi-scale filter and in the processing steps prior to applying the filter to the CTA images.

High Amylose Resistant Starch Diet Reduces Gut Inflammation in Rats With Chronic Kidney Disease
Kasim Manekia  
Mentor: Wei Ling Lau

Systemic inflammation is prevalent in CKD and is partially triggered by altered gut microbiome and
intestinal inflammation. These events are related to increase in urease-possessing gut bacteria, instigated by urea influx into the intestine lumen; these bacteria metabolize urea which is converted to toxic ammonium hydroxide which disrupts the epithelial barrier. Resultant translocation of bacteria and endotoxin into the bloodstream drives systemic inflammation. The CKD diet that limits dietary fiber also reduces density of gut bacteria that convert indigestible carbohydrates into short chain fatty acids—vital nutrients for colonocytes and regulatory T lymphocytes. We hypothesized that a diet consisting of high resistant starch will improve gut epithelial barrier integrity and decrease tissue inflammation. Male Sprague Dawley rats were fed a 0.7% adenine diet for two weeks to induce CKD. For the next three weeks, rats were fed diets containing amylopectin (low-fiber control) or high fermentable fiber (amylose maize resistant starch, HAM-RS2). CKD rats consuming the low fiber diet exhibited upregulation of pro-inflammatory molecules, down-regulation of antioxidant enzymes, and disruption of epithelial tight junction through various segments of the gastrointestinal tract. The diet with high resistant starch significantly decreased these pathologic findings. We previously reported that the resistant starch diet reduced progression of kidney failure in this rat CKD model. In conclusion, a high resistant starch diet lessens gut oxidative stress and inflammation, and restores expression of tight junction proteins in CKD rats.

Clinical Variations and Treatment Responses in IgM Related Neuropathies—Retrospective Analysis of a Ten-Year Experience at UC Irvine
Fatima Maqsood
Mentor: Namita Goyal

Plasma cell dyscrasias or monoclonal gammopathies are associated with clonal expansion of plasma cells and production of clonal population of immunoglobin moieties. IgM related monoclonal gammopathy generally has a late onset and often has no associated symptoms. The incidence of gammopathy increases with age; after the age of 70 years, up to 5% of the population may have such a gammopathy. Of the different gammopathies, IgM associated gammopathies have the highest association with development of an immune mediated neuropathy, often with a demyelinating pathology. IgM neuropathies have routinely been treated with immunosuppressive and immunomodulatory therapy but there is no controlled evidence as to whether or not these treatments work. Furthermore, there is a lack of clarity on the classification as well as the criteria used to define these antibody associated neuropathy syndromes. This study aimed to investigate the efficacy of treatments for IgM associated gammopathies via a retrospective chart review of all the cases of IgM associated gammopathies at the University of California, Irvine Medical Center in the past 10 years. Data was collected on patient characteristics, including data on IgM levels and treatment response. We used the collected data to explore the relationship between the treatment given and its effectiveness in treating IgM related gammopathies. The analysis of data is currently ongoing and will be complete by the time of the Undergraduate Research Symposium.

Parks and Crime: The Linkages between Neighborhood Park Crime and Socioeconomic Distribution within Southern California
Linet Mardyrosian
Mentor: John Hipp

The relationship between urban crime rates and residential neighborhood parks is one that has yet to be fully studied within the literature of urban planning and social ecology. This project serves as a case study of ten neighborhood parks located in the city of Los Angeles, five of which are in low-income city tracts and the other five in high-income tracts. The parks were chosen based on socioeconomic factors and also based on their ethnic makeup, some being in predominantly ethnically diverse tracts while others are considered more ethnically homogenous. The main objective of this project was to find linkages between crime rates within parks and the socioeconomic disparities within each city track. Using Google Streetview as my main instrument for this project, I was able to create a visual narrative for each park in regard to usage, facilities provided to the neighboring community, and also compare and contrast the parks across each tract. The differences, I found, are also connected to a general disparity between the parks’ amenities and usages across the various tracts studied. As other research has suggested, parks may contain certain features, which may or may not incite crime within that particular neighborhood known as “crime generators” (Groff, 2011). This study supports the theory of crime generators within parks in regard to a potential increase in social disorder within the surrounding community.

Effects of Diet during Two Stages of Development on Adult Secondary Sexual Traits of Male Taeniopygia guttata
Benjamin Martin
Mentor: Nancy Burley

Quality of diet can have a large effect on an organism’s growth, survivorship, and may influence reproduction in adulthood. Females are choosier when it comes to picking mates because they invest more in the offspring. This leads to males competing for female attention and more pronounced secondary sex traits in males. Thus, for males, the quality of food resources in early life could
affect access to mates later in life. This experiment aims to determine if quality of diet during two developmental intervals affects the development of rufus cheek patches in male zebra finches. Parents were allowed to reproduce on one of two diets, HI or LO. After young birds became independent of parents, they were randomly assigned to complete development on either the LO or HI diet, such that the diet of half the birds was switched. The results showed that cheek patches of the birds initially raised on a HI diet (HI-HI and HI-LO) had significantly larger cheek patches than birds originally raised on a LO diet (LO-HI and LO-LO). This means that a higher quality natal diet leads to larger cheek patches. There was no significant relationship between the juvenile diet and cheek patch size, indicating that birds cannot compensate for a poor natal diet if conditions later improve. These results indicate that the quality of natal diet has a significant effect on the development of cheek patches in male zebra finches and suggests that natal diet may have an effect on their reproductive success.

The Obesogen Tributyltin Commits Mesenchymal Stem Cells to the Adipose Lineage
Eric Martinez
Mentor: Bruce Blumberg
Obesity rates in America have tripled during the past quarter century, placing the population at risk for numerous comorbidities, including heart disease and diabetes. Diet, exercise, genetics, and smoking are extensively studied, well characterized contributors to the obesity epidemic, though they may not sufficiently explain the dramatic and abrupt rise in obesity worldwide. We study a class of endocrine disrupting chemicals that are persistent in the environment termed “obesogens,” which can alter fat tissue development to increase obesity risk later in life. We used the model obesogen tributyltin (TBT), which has previously been shown to increase fat depots in mice exposed in utero. TBT is known to act through the peroxisome proliferator-activated receptor (PPARγ) and the retinoid X receptor (RXR) to bias the stem cell precursors of fat—mesenchymal stem cells (MSCs)—towards an adipose fate. MSCs differentiated in the presence of TBT will form excess fat and less bone. We developed an in vitro assay to assess if MSCs exposed to TBT prior to differentiation would be committed to an adipose fate. Our results indicate that pretreatment with TBT prior to adipose differentiation induced more lipid accumulation, results that parallel existing in vivo data from mice exposed in utero. We also show that this effect appears to be independent of PPARγ, but dependent on RXR. This in vitro model is a new and powerful tool to identify obesogens that can commit MSCs to the adipose lineage, and to parse out the molecular mechanisms through which they achieve these effects.

The Role of Abuelos on Latina/o College Students’ Experiences
Katherine Martinez
Mentor: Jeanett Castellanos
As Latina/o students numbers grow in academia, concerns about retention, persistence, and college satisfaction arise for college personnel and administrators. Given the high attrition rates, and low student satisfaction it is imperative to understand the factors that contribute to Latina/o college student persistence. The purpose for this study was to examine abuelos’ influence on Latina/o students’ college experiences. Using the psychosociocultural framework, the study explored the psychological, social, and cultural influences abuelos have on Latina/o college student lives and their college choices and persistence. The role of motivation, empowerment, coping, social support, consejos, unique cultural values, and cuentos (life stories) were assessed. Methods of data collection included a 4–5 page essay where approximately 40 Latina/o students were asked to address memories of their grandparents, their grandparents’ background, and any influence on their coping techniques, cultural values, and education. Specific themes of the questions include: (1) family and education, (2) values and coping, and (3) abuelos’ influence on education. Data was put into themes and analyzed quantitatively according to these themes. Findings were validated and enumerated. Emergent themes included: Coping, Resilience and Perseverance, Educational Support, Dichos and Consejos (proverbs and advice), Values, and Life Lessons.

Quantitative Characterization of Electroencephalography for Epilepsy Detection
Swirl Mathur
Mentor: Beth Lopour
Infantile Spasms is a catastrophic childhood epilepsy disorder that hinders brain development and may cause severe cognitive disorders or premature death. An Infantile Spasms diagnosis is based on the presence of an abnormal electroencephalographic (EEG) pattern called hyspsarrhythmia. Hyspsarrhythmia is typically defined as a high amplitude, low frequency, chaotic signal that is present throughout the brain and is persistent over time. However, the definition and characterization of hyspsarrhythmia is highly subjective and non-uniform. Previous studies have shown that inter-rater reliability in characterizing hyspsarrhythmia is extremely low. Therefore, there is a strong clinical need for a reliable, objective method of identifying the signal parameters that are indicative of hyspsarrhythmia. I developed signal processing algorithms for the
characterization of local and global amplitude and frequency trends of an EEG signal. This data may aid neurologists in accurately identifying hypersrhythmia and therefore diagnosing Infantile Spasms. A total of 35 patients with various neurological conditions were analyzed. The initial results of the detection software were compared against ratings made by six neurologists to determine the correlation between the quantitative and qualitative observations. I found a promising positive correlation between the software-defined amplitude variability, and neurologist-defined hypersrhythmia diagnosis. Additionally, the results of the detrended fluctuation analysis, a measure of signal frequency, aligned with neurologists’ diagnosis of hypersrhythmia. Therefore, amplitude variability and detrended fluctuation characteristics may be used prospectively as unbiased biomarkers of hypersrhythmia.

**CHP/BFA Thesis: Beauty is…**

Natalie Matsuura

*Mentors:* Diane Diefenderfer, Loretta Livingston

Beauty is an incredibly broad concept that has intrigued philosophers, artists, and laymen for centuries. Definitions of beauty are diverse and often conflicting, and the lengths to which people have gone to make themselves “beautiful” are extreme. I researched how Beauty has been defined by different epochs and thinkers, from Classical Greek philosophers to modern psychologists. I found that classical Greek beauty has been one of the most definitive and influential factors in art and aesthetics. It is characterized by the elements simplicity, harmony, clarity, symmetry, and serenity. These elements are reflected in classical Greek sculpture, architecture, and paintings. Symmetry in human bodies was also one of the highly rated factors in determining beauty and attractiveness. Qualities (such as symmetrical faces, healthy pallor or complexion) that indicated youth and fertility are highly linked to human attractiveness, particularly with regard to the female body. These elements are indicators of health and reproductive fitness, which were important from a biological and evolutionary standpoint with regard to the survival of our genes. I also found that a recurring ingredient for beauty is contrast, or opposition. From Nietzsche’s writings on Apollonian vs. Dionysian Beauty in his work, the Birth of Tragedy, to the more modern artists described by Umberto Eco in his book, History of Beauty, the importance of opposition and contrast was repeatedly emphasized. I used these elements from literature and art to build an original choreographic work that illustrates Beauty according to these historical figures and epochs. I will be presenting an excerpt of my choreography with two of my peers who have been working on similar projects, and with whom I will be staging my original choreography in a full concert May 15-16.

**Angelitos Negros: A Work by Donald McKayle**

Natalie Matsuura

*Mentor:* Donald McKayle

In recollection of the 2014 dance exchange between the UCI Etude Ensemble and the dance department of UC Santa Barbara, Natalie Matsuura will be performing Angelitos Negros. Dance legend Donald McKayle is the director of the Etude Ensemble and choreographed this piece along with four other dances as part of the Songs of the Disinherited. Mr. McKayle’s work is an expression of the human condition and tackles subjects such as liberation, redemption, and mortality. The exchange with Santa Barbara allowed us to share this expression with a new audience. We were also able to foster a positive relationship with our sister school and build a community with the Santa Barbara dancers. Angelitos Negros was performed at the Santa Barbara performance, and is a sample of the work that we shared during the exchange.

**Panama Dance Movement Exchange**

Natalie Matsuura

*Mentor:* Lisa Naugle

In my research for SURP, I traveled to Panama in collaboration with the non-profit organization, Movement Exchange, to bring dance to the local at-risk youth and promote social justice. Investigating dance as a universal language, learning cultural differences, and teaching in a foreign language exposed the power of art and movement to connect people despite vast differences and limited verbal communication. My research team and I used a set of motor exercises called the “Brain Dance” to compare cognitive and motor development of children in different environmental and family circumstances. We found that the children in the less structured and nurturing home environments had more difficulty with basic coordination and were more difficult to control during lessons than those of better familial and social circumstances. Through my research, I discovered that dance and art are profoundly powerful in garnering mutual respect and communication between people of stark differences. I found that physical touch is important in social development and trust, and that art in education is incredibly valuable and important for child development.

**Sex Education in America**

Melissa Mayr

*Mentor:* Alison Holman

The purpose of this project is to develop a one-unit seminar through the uTeach program. The course focuses on two main philosophies of sex education in
America, abstinence-only education and comprehensive sex education. After reviewing the literature, it was found that the Abstinence-Only Programs that were used in the past have been proven ineffective in reducing unhealthy sexual behaviors and a comprehensive education has been deemed a “basic human right of youth” (Advocates for Youth, 2008). There is controversy surrounding educating the youth on sex based on religious, cultural, and historical norms and values, which further stunts discussions on the best methods to educate. By educating the community at UCI and engaging students in a critical discussion of possible solutions to a complex problem, the course tackles a public health issue that hopes to reduce emotional trauma, sexually transmitted infections, and unwanted pregnancy. Thus, the final results of this research project include defining the purpose of the seminar: to analyze the progression of standardized sex education and the effectiveness of sex education in preparing youth to be competent, knowledgeable, and successful in forming healthy sexual relationships. We explore the question: what is the best way to engage American society in learning and adopting healthy sexual behaviors? The intended outcome is for students to be well-informed, to have critically analyzed the effectiveness of current sex education methods, and be innovative and collaborative in improving a sex education lesson plan to make it more effective and applicable to contemporary America.

Measuring the Natural Abundance of Radiocarbon and Stable Isotopes of Groundwater to Monitor Anthropogenic Recharge within the Orange County Coastal Basin

Junior Mazariegos
*Mentor:* Claudia Czimczik

In Orange County, CA, the Orange County Water District has undertaken strict groundwater management measures to ensure the long-term sustainability of the coastal groundwater basin, including enhancing natural and anthropogenic recharge. We conducted a basin-wide analysis of ground and surface waters to identify if the recharge-water has a unique isotopic signature. Groundwater was collected from six routinely producing, privately-owned wells within the coastal groundwater basin from September 2014 to April 2015. In addition, water samples were occasionally collected from two monitoring wells as well as from the Newport Beach Pier and Santa Ana River. Samples were analyzed for their radiocarbon and stable isotopic ($\delta^{13}C$, $\delta^{18}O$, and $\delta^2H$) composition. We found that groundwater from two production wells were enriched in radiocarbon above natural background levels and that the signal strength varies in time. The stable isotope composition suggests that these waters are a mixture of Colorado River water and regional groundwater and Santa Ana River water. These wells are located in the pressurized region of the aquifer close to the Talbert Injection Barrier, which is a source of replenished water. In contrast, water in the foreshore region has a radiocarbon signature and stable isotope composition consistent with regional groundwater and Santa Ana River water. Our findings suggest that the injection barrier maybe introducing isotopically-unique groundwater enriched in $^{14}C$ that could be used as a tracer of anthropogenic recharge within the basin.

Black Economic Discourse, Assessing Wealth, Gender, and Linked Fate

Jazmyne McNeese
*Mentors:* Samuel Gilmore, Tiffany Willoughby-Heard

Black people in the United States have a vibrant economic history especially with regard to the use of cooperative economic institutions and organizations. Despite racist myths about black people lacking the capacity to build and sustain economic organizations many scholars have proven the opposite. This paper explores the continuing prevalence of poverty that exists in the black community contrary to the vital economic contributions and organizational life of black people. To understand this paradox I have examined philosophies about black cooperative economic institutions (specifically credit unions) such as, what wealth actually is and what wealth is for, the practices of linked fate or collective consciousness and how gender hierarchies have shaped the actual organization of black financial institutions. A final aspect of black economic discourse is that slavery is the economic foundation that continues to shape the relationship that black people have to economic stability. Focusing on economics and race in this study deploys the history of black economic cooperatives to analyze how the Black community has provided for itself. The practices of pooling resources and developing cooperative economics, according to Jessica Gordon-Nembhard, demonstrate that Black People for centuries have been working together, organizing, and consciously building community as a collective in various organizations for survival. Ultimately, this project counters the idea that Black people are poor because of character or cultural deficiencies or laziness. In it I shine a light on the hidden economic histories and the structural violence that dismantles Black economic progress in this country in 2015.

Supporting Physicians by RE4S

Joseph Mehrabi
*Mentors:* Birgit Penzenstadler, Debra Richardson

Sustainable development applied to software engineering means developing systems in a sustainable way (domain-independent), as well as supporting sustainability in the
application domain (domain-dependent). Developing sustainable software begins with requirements engineering (RE). RE for sustainability (RE4S) outlines the process of RE while taking steps to make the system more sustainable. This approach answers the question, “What should this software system do while contributing to overall sustainability?” This project considers how sustainability impacts the requirements engineering process for a software system for medication adherence. The examined system, Project Cognatio, is targeted toward outpatient medical practices with the goal to improve medication adherence among patients. We found considering the dimensions of sustainability can significantly enrich a number of RE artifacts and thereby inform system’s design. This analysis proves useful for the future development of Project Cognatio and shows that RE4S can improve software development’s contribution to sustainability.

**Fluorescent Polydiacetylene-Coated Magnetic Nanoparticles for Tumor Detection**

*Louis Mejia*

*Mentor: Jered Haun*

Coated nanoparticles are a growing branch of nanotechnology used in a variety of applications from biological imaging to the detection of target tumor cells. Magnetic nanoparticles (MNPs) have a wide range of applications, including magnetic resonance imaging, when used in vivo. We have created our own MNPs through a unique process known as the dual solvent exchange method that allow the particles to become soluble in water via the addition of a polydiacetylene coating. After immersion in ultraviolet light, the MNPs become a distinctive deep blue color through the polymerization of the coating layer. Increasing the temperature or pH of the particle solution further changes the color to a brilliant red. We are currently in the process of perfecting our particles in order to measure their magnetic properties. Future goals for the project include adding tetrazine to the MNPs and binding them with modified antibodies embedded in trans-cyclooctene. This will form larger nanoclusters containing high densities of our optically detectable nanoparticles. With this novel method, we hope to greatly amplify the signals emitted for easier detection once our nanoclusters bind with target tumor cells.

**1U CubeSat ADCS System Design and Testing**

*Gleb Melnikov*

*Mentor: Manuel Gamero-Castano*

Nanosatellites are becoming increasingly common due to their significantly reduced manufacturing and launch costs compared to larger satellites. Developing precise attitude control systems for such compact satellites has historically been a challenge due to their size and power constraints. The aim of this project was to develop an efficient Attitude Control and Determination System (ACDS) for a 1U CubeSat using miniaturized electrospray thrusters. Colloidal thrusters were fabricated using a lathe and milling machine, and were tested separately in a vacuum chamber using passive propellant feeding. Several propellants were tested. Ethylammonium nitrate (EAN) was found to possess the highest specific impulse within the mass flow regime where a stable cone-jet is formed, thus making it the preferred propellant. After passive propellant feed testing, the CubeSat was assembled with thrusters positioned at diametrically opposed corners and wireless control and power systems installed. Final testing was performed on the CubeSat in a vacuum chamber, in which it was suspended using a thin tungsten wire. Testing was unsuccessful, as the Arduino microcontroller used in the wireless control system broke down within seconds of activation. Separate vacuum compatibility tests for the wireless control and power systems should be performed in future experiments, as it is likely the thruster system would perform well based on the successful results obtained from passive propellant feed testing.

**Compliance with Recommendations for Change in Anti-Psychotic Medication in Patients with Developmental Disabilities**

*Eric Mendez*

*Mentor: Christy Hom*

Patients with developmental disabilities (DD) display a wide range of maladaptive behaviors varying in severity and frequency. A challenge with treating the maladaptive behaviors of patients with DD is knowing whether their caregivers are following physician recommendations. We hypothesized that caregiver satisfaction with medical evaluations would affect compliance with treatment recommendations. Furthermore, we hypothesized that level of compliance (adherent vs. nonadherent) would affect patient outcomes (i.e. frequency and severity of maladaptive behaviors post-clinic evaluation). Using an outpatient clinic sample of fifty children and adults, our study analyzed whether adherence to pharmacological or other medical and mental health recommendations resulted in improved outcomes for DD patients with maladaptive behaviors. Patients’ primary caregivers were contacted via telephone within a year after a multidisciplinary evaluation and administered a patient/caregiver satisfaction survey and the Scales of Independent Behavior-Revised Edition’s (SIB-R) Maladaptive Behavior Index. Patients’ scores from their clinic evaluation were compared to their scores on the same index 6–12 months later. We found that there was an overall decrease in the frequency of maladaptive behaviors for all patients, regardless of their level of adherence to recommendations.
compliance with the treatment recommendations. Additionally, caregiver satisfaction with the clinic appointment wait time, process, or (include all variables) did not affect compliance rates with the treatment recommendations. Possible reasons for patients’ overall improvement regardless of level of compliance are discussed, as well as possible reasons why caregiver satisfaction did not affect compliance rates.

**Toward an Efficient and Stereocontrolled Synthesis of Pseudopterosins**

Mitchell Miller  
*Mentor:* Chris Vanderwal

Pseudopterosins are a class of natural products isolated from specimens of the genus Pseudopterogorgia, a sea sponge that is the source of these (and many other) metabolites that are noteworthy for both their structural and pharmacological aspects. Therapeutically, these compounds are most acclaimed for strong anti-inflammatory activity. Due to low concentrations within the natural source and costly purification, chemical synthesis remains a desirable strategy for obtaining pseudopterosins. The synthetic interest and principal aim of this research was the implementation of an *anionic Oxy-Cope – transannular Michael cascade* (AOC/TM), a powerful rearrangement that represents a pivotal transformation in the synthetic route. This rearrangement was never performed however, as progress toward the core structure was halted by recurring unsuccessful attempts to complete the reaction that precedes the rearrangement. The obstrinate reaction (a nucleophilic addition using propynyllithium) has not yet proven successful on the system of study, but was first carried out on a model aldehyde system and achieved success after many trials. Small improvements were achieved through screening reagent conditions and reaction time, but in the end there were two deciding factors. It was observed over multiple trials the aldehyde must be added to the solution of propynyllithium (and not the reverse) in order for the reaction to occur. Another observation was that the reaction vessel must be removed from -78 °C conditions immediately after the addition of reagents is complete, allowing a gradual rise back to room temperature. These observations contrast with several procedures described in literature, and could be suggestive of substrate-dependent variables worthy of further investigation. If serving no other purpose, the data and observations collected through these trials can surely serve as guiding points for continued research on the synthetic route toward pseudopterosins.

**Engineering Neutral Regions in Nanofluidic Diodes**

Tabitha Miller  
*Mentor:* Shane Ardo

Nanopores-sized channels in bulk materials, *i.e.* nanopores, allow one to selectively control and sense nanoscale ion flow, which is useful for a myriad of applications, such as microfluidic sensors and biosensors. Fundamentally, the solution transport within these nanopores differs from bulk transport phenomena and is not well understood. Nanopores are appealing to the Ardo Group because they exhibit non-linear rectifying current-voltage (I-V) responses, a perquisite for light-driven proton pumping. The Ardo Group hypothesizes that protons generated photochemically in nanopores will be driven unidirectionally due to this non-linear response. My aim is to examine and clarify one aspect of the transport phenomena in nanopores using a carefully controlled parameter space, described further below. Conical nanopores in plastic polyethylene terephthalate (PET) thin films can be synthetically altered for patterned surface charges that line the nanopore. The alteration of the surface charges creates proximal positive regions (p) and -negative regions (n) that form a p-n junction. By introducing a sensitized region in the middle of the p-n junction, the films become responsive to light to pump protons through the pore. A p-n junction can be made from conically shaped nanopores in PET thin films by functionalizing the inner surface with molecules. The p-n junction rectifies current like a diode, which means its resistance is dependent on the direction of bias polarization of the cell, similar to what occurs in a semiconductor p-n junction. Under reverse bias a depletion zone forms, thus increasing the resistance of the pore and attenuating flow.

**Use of Simulation in Human Powered Airplane Design and Analysis**

Nima Mohseni  
*Mentor:* Kenneth Mease

Human powered aircraft have unique flight characteristics that a pilot must learn how to handle during their first flight. This is risky, as a slight pilot error could leave years of development and production ruined and set a human powered airplane project back to its first production stages. This risk can be minimized by training the pilot on the ground before they step inside the aircraft for the first time. The goal of this project is to create a flight simulator interface in order to train a pilot about the flight characteristics of human powered aircraft. A model of UC Irvine’s current human powered airplane was created and analyzed in AVL (Athena Vortex Lattice) CFD software and compared to a model
created in X-Plane 10 flight simulation software to prove the feasibility of using flight simulation to accurately model human powered aircraft. A physical interface was created in order to have the pilot control the aircraft in a similar fashion to how the UC Irvine human powered airplane will be flown. It was found that the simulation software is able to closely model the flight characteristics of the aircraft as well as provide accurate inflight data for analysis. These results show that the use of simulation in pilot training is possible for human powered aircraft.

**The Unseen Hard Work of Young Active Adults in the Age of Mass Social Media**

**Blanca Molina**  
**Mentors:** Ana Rosas, Tiffany Willoughby-Herard

Political participation and civic engagement are scrutinized through conventional methods, which are used to assess young adults’ political contribution. The public discourse about young adults and social media tends to be that of disengagement and disconnectedness. Political scientists have examined diverse spectrums regarding the subject, but it is evident that social media and politics have a symbiotic connection. Young adults have created community discourse, amplified issues, and created movements that transcend virtual boundaries. These creations come out of blog, twitter, and Facebook accounts. The hashtags and virtual communities created by these hardworking young adults are funneled in “slacktivism” rhetoric. However, these fundamental platforms are spaces for political engagement, and ultimately powerful techniques for change. The purpose of this project is to rethink young adults’ political engagement. Thus, political institutions must learn how to work together with virtual communities that have actively worked hard to be heard.

**Investigation of the Role of C5a in the Proinflammatory Response Elicited by Fibrillar Amyloid Beta in Microglial-Like BV2 Cells**

**Karina Molostova**  
**Mentor:** Andrea Tenner

Inflammation in the brain has been shown to play an important role in the pathophysiology of Alzheimer’s disease (AD). Peptide amyloid-beta (Aβ) deposits have been found in AD brains. Microglia are recruited by C5a and have Toll Like Receptors (TLRs), which play an important role in binding of Aβ assembled into β sheet fibrils (fAβ). Upon binding of fAβ, microglia become activated and secrete inflammatory factors such as nitric oxide (NO). In the past, a synergistic relationship between C5a and fAβ have been shown in THP-1 cells, a macrophage cell line. We hypothesize that C5a can synergistically enhance the proinflammatory response elicited by fAβ in mouse BV2 cells. IFNγ plus fAβ have also been shown to produce higher NO levels. A subset of the hypothesis also tests synergistic effects of fAβ with IFNγ as well as C5a with LPS to explore what signals may synergize with TLR stimulation of microglia. BV2 cells were plated at 25,000 cells/well in a 96 well plate. The cells were stimulated with C5a, fAβ, LPS, and IFNγ. The NO levels were assessed using a colorimetric Griess reaction. The results showed that there was no synergistic relationship between C5a + fAβ at any concentrations. However, there was statistical significance between 100nM C5a + 30uM fAβ + 10U/ml IFNγ. Also, an increase in NO levels with 1nM C5a + 10ng/ml of LPS was shown. This indicates that synergy could be possible in the BV2 cell line and that perhaps other inflammatory factors are needed to promote the response.

**Stimuli-Responsive Liposomes for Targeted Chemotherapeutic Delivery**

**Zaki Molvi**  
**Mentor:** Young Jik Kwon

The viability of functionalized liposomes as a targeted chemotherapy drug delivery system was investigated. Liposomes loaded with the anticancer drug Doxorubicin (DOX) were functionalized with an acid responsive polymeric shell to create a novel pH-sensitive drug carrier. This design was assessed through controlled experiments comparing it to other liposomal configurations, including DOX-loaded liposomes with a nonfunctional polymeric shell and DOX loaded liposomes without any modifications at all. Surface modification of the liposome was evaluated through fluorescence spectroscopy, polymerization confirmed through dynamic light scattering (DLS) characterization and transmission electron microscopy (TEM) imaging, and finally, drug release profiles were created by measuring drug concentration in eluted buffers.

**Mexican Americans’ Social Mobility and Assimilation in the U.S.: An Examination across Generations**

**Patricia Morales**  
**Mentor:** Jeanett Castellanos

The Latina/o community is one of the fastest growing immigrant groups in the country. Mexicans are the biggest group within the ethnic group. Given their representation and influence in the nation, it is important to understand the group’s social adjustment, mobility, and cultural adaptation. Using the Theory of Segmented Assimilation, this study analyzes the exogenous factors that influence Mexican Americans’ path of assimilation. Exogenous factors include human capital, family composition, and social context. Through a mixed methods design, the study examines factors that influence immigrant mobility by examining the
phenomena across generations. Reviewing data collected from the Immigration and Intergenerational Mobility in Metropolitan Los Angeles (IMMLA) database and qualitative data collected through interviews, this study outlines the path of assimilation of Mexican Americans in America. Preliminary findings suggest Mexican Americans are facing selective acculturation, limited upward mobility, and partial integration into mainstream society. Results will provide implications for research and practice.

**The Effects of Sucrose Addition and Warming on CO₂ Respiration from Arctic Soils**
Grace Mortero

*Mentor: Claudia Czimczik*

Rising temperatures in the Arctic are causing environmental changes, including more abundant plant growth (*i.e.* “greening”). Greening is hypothesized to introduce more labile carbon into arctic soils and either stimulate the microbial decomposition of organic matter and thus soil respiration (*i.e.* positive priming), or reduce soil respiration due to secondary nutrient limitation (*i.e.* negative priming). These priming effects may be further amplified by continued warming. Here, I investigate the effects of labile carbon addition and warming on CO₂ respiration from arctic soils through a laboratory soil incubation. Labile carbon addition is simulated by adding isotopically labelled sucrose, and warming by performing the incubation at two temperatures (22 and 7 °C). Three replicate soil cores were collected from a moist acidic tundra ecosystem near Toolik Field Station, AK, U.S.A, and sectioned into organic, upper, and lower mineral samples. I observed that the direction and magnitude of priming differed as a function of soil horizon and incubation temperature. Organic soils showed significant positive priming at 22 °C, but no priming at 7 °C. Upper mineral soils exhibited slight negative priming at 22 °C, but no priming at 7 °C. Lower mineral soils did not exhibit priming at either temperature. These findings suggest that ongoing warming and greening in the Arctic may stimulate carbon losses from organic soils via positive priming. In mineral soils, carbon turnover appears to be limited by secondary nutrient limitations and requires further investigation.

**Education for Survival: Educational Movements and Philosophies of the Black Diaspora**
Johan Mosquera

*Mentor: Tiffany Willoughby-Herard*

This research examines educational movements that are built on the philosophy that education should be used to promote a truly democratic society by “teaching for social justice.” Education is important to Black people because segregated and inferior education is a cornerstone for the social segregation, economic exploitation and political oppression of Black people. By respecting the unique knowledge that Black students have of the social issues they confront, this educational philosophy allows students to orient themselves toward fighting injustice. Black educators recognize that access to this quality of education constitutes corrective justice. This civil rights-based understanding challenges the ideologies that argue for Black student’s access to quality education based on diversity’s accrued benefits to institutions of higher education. This educational philosophy recognizes that Black students have the unique capability to address the problems that they endure as members of historically oppressed groups. The lack of quality education oriented towards social justice and liberation means that schooling ends up being largely about disciplining Black students in order to maintain the unjust socially-constructed arrangement of power, both inside the school and outside in the broader society. Ultimately, the educational movements and Black scholars in the United States, South Africa, and Brazil indicate that for Black people education is anti-racist work.

**Structural Equation Modeling of Biofilters**
Ava Moussavi-Aghdam

*Mentors: Stanley Grant, Megan Rippy*

Biofilters are engineered systems designed to capture and treat urban runoff. Biofilters use natural processes to remove contaminants that threaten local ecosystems (*e.g.*, nitrate, pesticides) and/or public health (*e.g.*, pathogens and indicators of pathogens such as fecal indicator bacteria (FIB)). Understanding the mechanisms controlling pollutant treatment in biofilters is crucial for their successful design and implementation. For this reason, I used structural equation modeling (SEM) to evaluate different hypotheses concerning FIB removal in biofilters. I focused on the importance of three biofilter design components: (1) biofilter media composition (*e.g.*, the ratio of sands to fines), (2) plant presence/absence, and (3) the presence/absence of a saturated layer at the biofilter base called a submerged zone (SZ). Because all three design attributes have the potential to impact FIB removal indirectly as well as directly, I evaluated the significance of both effect types in my model. Only SZs were found to impact FIB removal by both direct and indirect paths. SZ biofilters had higher overall FIB removal (positive direct effect) and reduced infiltration, which also increases FIB removal (negative indirect effect). Filter media composition had a significant (negative) direct effect on FIB removal, but no indirect effects. Plants had no direct effects on FIB removal, but did impact it indirectly through reducing infiltration. Overall my work suggests that all three design components have implications for FIB removal in
biofilters. SZs appear to impact FIB removal in multiple ways and thus warrant further evaluation as a design component in these systems.

**Unusual Tumors in VCP Associated Inclusion Body Myopathy**

Kady Murphy  
*Mentor: Virginia Kimonis*

Inclusion body myopathy with Paget’s disease of bone and frontotemporal dementia (IBMPFD) is an autosomal dominant inherited disorder caused by a mutation on chromosome 9p13.3-12 in the VCP gene. IBMPFD is usually characterized by muscle weakness and atrophy, a disruption in the body’s bone recycling process, and degeneration in the frontal lobe. There is no cure for IBMPFD and patients usually die in their 50s or 60s due to respiratory or cardiac failure. The VCP protein plays many roles within the cell, including those in cell cycle regulation, signaling pathways, protein quality control, and genome stability. In studies of multiple types of cancers, VCP has been shown to be upregulated. VCP expression is an indicator of prognosis in some cancers, with overexpression correlating with a lower overall survival rate. We have reviewed the medical records of 120 patients with IBMPFD from our database. We have observed several IBMPFD patients presenting with unusual tumors. Our first patient developed a recurring peripheral nerve sheath tumor. Our second patient presented with a recurring pleomorphic xanthoastrocytoma re-appearing after each of his four resections. A third patient presented with a malignant thymoma. Given that VCP overexpression is a common occurrence in cancer, we hypothesize that our patients’ VCP mutations, which are known to be upregulating mutations, put them at a higher risk for developing tumors. Currently, antitumor therapies include drug modifiers that reduce VCP expression. Similar therapeutic strategies may also be helpful in improving the myopathy, Paget, and neurological complications in patients with IBMPFD.

**Beyond kWh**

Veronica Nasser  
*Mentor: Richard Matthew*

Behavior-based energy interventions rely on the idea that people can be encouraged to use less energy if the underlying determinants of behavior change somehow. Most energy efficiency evaluations use the amount of energy used (measured in kWh) as the dependent variable for measuring effectiveness. Although this is an ideal measure of whether energy efficiency interventions work, additional information could add significantly to our understanding about how and for whom they work. Recent efforts have been made to include such information as more studies are now collecting self-reported data from participants in order to better understand how and for whom behavior-based energy interventions work. However, widespread agreement on what data to collect and how to collect it is still lacking. I read, coded, and analyzed previous studies on behavior-based energy intervention in the customer feedback and residential building retrofit areas, which were conducted over the past ten years to determine what data has been collected and how it has been collected. Our work suggests that future research should evaluate studies using standardized measures across a range of key variables. The use of a standard measure would enable cross-comparisons to be made across different studies, and the incorporation of questions about context, behaviors, attitudes, knowledge, and user experience, would provide researchers with insights into a richer understanding of how and for whom different behavior-based interventions work best. Finally, we recommend that study authors provide better transparency in the methods they use.

**B-O σ Bond Addition across Alkynes for the Synthesis of Borylated Heterocycles**

Nicole Nava  
*Mentor: Suzanne Blum*

Organoboranes serve as a class of important synthetic intermediates. Their subsequent reactivity makes them attractive options to rapidly synthesize complex molecules. Reaction of 2-alkynl phenols in combination with a Lewis acidic/Lewis basic catalyst allows for the previously unprecedented addition of boron-oxygen σ bonds across alkynes. This newly developed reaction, termed alkoxyboration, allows for the formation of a number of diverse, borylated heterocycles from a carboxylic acid motif. Synthesis of the precursor alkynyl substrates will be discussed, in addition to their gold-catalyzed reactivity.

**M.R.S.**

Raymond Naval  
*Mentor: Sheron Wray*

M.R.S. reflects a period of American history, focusing on the emotional states of women during this time. My ideas and inspiration on the aesthetics and lifestyles of women in America during the 1950s are displayed in a series of works throughout this production. I am creating movement based on the ideas, aesthetics, and relationships during this time period. M.R.S. refers to the “Misses” degree that women obtained as being a
housewife, having children, and staying at home. Much like today’s culture and the counter-culture of that time, it is probable that women wanted more in life than to just being tethered to the home and tending to the family. Especially during the 1950s, after women had nobly taken to the factories and augmented the U.S. workforce due to their husbands being sent to war, a desire for financial independence, work and growth permeated the climate. My thesis reflects the aspirations and desires of these women during the 1950s.

Evidence for Loss of p57Kip2 Imprinting in Choroid Plexus Epithelial Cells
Michael Neel
Mentor: Edwin Monuki

The choroid plexus produces the cerebrospinal fluid that bathes and circulates throughout the central nervous system. Similar to other neural tissues, the choroid plexus exhibits low levels of proliferation. Previous evidence from our lab suggests that choroid plexus epithelial cell (CPEC) proliferation is regulated by cell cycle regulator, p57Kip2. The p57 gene is a paternally imprinted gene, showing expression only of the maternal derived allele. Previous studies suggest possible biallelic expression of p57 in neural tissue, which may contribute to the low levels of proliferation. To address this question of whether p57 imprinting is maintained in CPECs, EdU staining and a p57 knockout (KO) mouse strain were used to observe cell proliferation in CPECs. To observe the effect of an individual p57 allele on proliferation, heterozygous mice were bred to have the p57 KO allele derived from either the mother or father. Proliferation was higher in both maternal and paternal KOs compared to wild type. The increase in proliferation in the maternal KO is expected, however, the increase in proliferation associated with the paternal KO may be indicative of paternal allele expression. This study indicates that p57 may lose its imprinting and exhibit biallelic expression in CPECs.

GIS Analysis of 911 Responses in Pacoima and Encino California: A Comparative Study
Norbert Negrea
Mentors: Joanne Christopherson, Caesar Sereseres

There has been an increasing use of technology in Emergency Management in order to improve provider performance in the field. Geographic Information Systems (GIS) is valuable in field-work, analysis, policy, and planning for organizations such as the law enforcement. Academic literature has countless studies citing GIS as an extraordinary tool for analysis of emergency management systems, and a powerful method for interpreting fire and police responses within a city. The Data Desk Department at the Los Angeles Times used a GIS analysis recently to discover a significant city-wide weakness in 911 response rates. Research also reveals fewer bystander CPR actions in low-income areas, compared with other areas, leading to higher risk of death in low-income areas. Variables of race/ethnicity have also been found to influence how law enforcement handle certain victims, particularly as victim follow-ups. Thus, diversity and economic status are related to variations in responses of different systems of emergency management. This study compares emergency response times in Los Angeles County neighborhoods, Pacoima and Encino. Six maps illustrate differences in fire and police department response times to 911 emergency calls in neighborhoods with variations in Hispanic/Latino populations, year structures were built, and household values and costs. The implications of the study will inform emergency systems in LA County, and encourage the incorporation of GIS into future analysis of service providers in the area.

Directed Differentiation of Human Induced Pluripotent Stem Cells into Medial Ganglion Eminence Progenitors Produce Functionally Active Neurons
Nathan Ng
Mentor: Diane O’Dowd

Genetic epilepsy with febrile seizures plus (GEFS+) is an autosomal dominant disorder that can be caused by many different point mutations in the Na.1.1 voltage-gated sodium channel. Our lab has used a Drosophila K1270T knock-in model and discovered a conditional gain-of-function alteration in sodium channels that reduces the excitability of GABAergic neurons. To determine whether this mutation causes similar changes in sodium channels and excitability in human neurons, we generated induced pluripotent stem cells (iPSCs) lines from three siblings, two with the GEFS+ K1270T mutation and one without (Control). In our initial studies Control iPSCs were used to derive expandable lines of neural stem cells (NSCs). However, when the NSCs were differentiated into neurons using standard procedures, only 10% of the cells examined were capable of firing action potentials and even fewer expressed GABA by 3–5 weeks. Additionally, there was significant heterogeneity in the degree of functional differentiation from plating to plating. Therefore we experimented with a recently published strategy for directed differentiation of iPSCs into medial ganglionic eminence (MGE) progenitors that had been shown to enrich cultures for GABAergic neurons. Three weeks after plating MGE progenitors onto mouse astrocyte feeder layers, approximately 28% of the MGE derived neurons arising from Control iPSCs were GABAergic. Nearly all recorded cells were capable of firing action potentials, with evidence of GABAergic and/or glutamatergic synaptic inputs. This differentiation protocol will also be
useful in determining how other genetically induced neurological disorders affect neuronal maturation and function, facilitating development and testing of novel therapies.

**The Genetic Basis of* D. melanogaster*-D. simulans Interspecies Difference in Ethanol Resistance**

Luna Ngo  
**Mentor:** J.J. Emerson

Understanding the genetic basis of adaptation has remained one of the major goals of evolutionary biologists. Yet, little is known about why a trait that serves as an adaptation in one species does not evolve in its closely related species. For example, *D. melanogaster* has the ability to adapt to stressful concentrations of dietary ethanol, whereas its sibling species *D. simulans* cannot. Identifying the nature of the genetic changes that are lacking in *D. simulans* but allowed *D. melanogaster* to become resistant to stressful concentration of ethanol is pertinent to understanding the nature of constraint that prevented evolution of ethanol resistance in *D. simulans*. Here I investigated the genetic basis of mel-sim difference in ethanol resistance using interspecies crosses. In particular, I investigated the effect of Aldehyde dehydrogenase gene, which encodes an enzyme indispensable for ethanol detoxification in flies, on the mel-sim difference in ethanol resistance. I found that the hybrids between *D. melanogaster* and *D. simulans* are nearly as ethanol resistant as *D. melanogaster*, suggesting that genetic changes that increase ethanol resistance in *D. melanogaster* are dominant over their *D. simulans* counterparts. Nonetheless, the difference in *Aldh* gene of the two species does not account for the difference in ethanol resistance. Further investigations are being carried out to test the effect of the Alcohol dehydrogenase enzyme gene, which is also indispensable for ethanol detoxification in *D. melanogaster*, on the interspecies difference in ethanol resistance.

**Food Insecurity: A Santa Ana Case Study**

Aileen Nguyen  
**Mentor:** Marianne Bitler

A neighborhood is described as a food desert when a low-income community has low access to nutritious food. A neighborhood is described as a food swamp when there are many options for purchasing food, such as fast food chains and convenience stores, but the barriers to healthful foods are cost and time. Orange County is the second most food-insecure county in California, second only to Los Angeles County, in part because the physical and economic barriers restricting access to nutritious food are too high. This project aims to highlight the prevalence of food insecurity in a particular neighborhood (or hoods) in Santa Ana, California by observing the city’s general food retailer map for those neighborhoods and through anonymous interviews so as to discern whether Santa Ana is a food desert or food swamp. This project also hopes to shed light on the city’s policies toward alleviating current food insecurity in conjunction with food retailers’ participation in federal programs such as the Supplemental Nutrition Assistance Program for low-income families. This study has found that while Santa Ana is not a complete food desert, there are neighborhoods that would classify as such; however, it can still be considered a food swamp due to the ineffective public transport system and general distance to an affordable food retailer with high quality, high variety options for nutritious food.

**Selection of RNA Aptamers from Human and Metagenomic DNA Libraries by in vitro Selection**

Andy Nguyen  
**Mentor:** Andrej Luptak

RNA possesses properties of having high affinity towards specific ligands, through folding of its secondary structure, known as aptamers. In nature, aptamers exists as ligand-binding domains in riboswitches and play an essential role in regulating gene expression. Recent studies revealed the presence of these aptamers within human and various species that have high affinity toward ligands such as adenosine triphosphate (ATP). These findings raise several questions: Do other aptamers exist and have an affinity towards similar ligands within humans? Are these aptamers present and conserved among other species? To address these questions, we carried out an in vitro selection process to select for adenosine 3’,5’ cyclic monophosphate (cAMP) and N’-actyl-D-galactosamine (GalNAc) aptamers within a metagenomic pool and human genomic pool respectively. This is achieved by exposing RNA transcripts from the genomic pool to the ligand of interest. Those that show affinity towards our target are amplified and the cycle repeats until obtaining an enriched sample of RNA with high affinity towards the desired targets. Our data suggest an enrichment of cAMP and GalNAc aptamers possessing high affinity towards the target ligands, with some having been mapped onto organisms. This suggests the presence of cAMP or GalNAc aptamers within humans and other organisms that may play a role as part of riboswitches in regulating gene expression.

**Generation of Microglia from Human Pluripotent Stem Cells**

Cecilia Nguyen  
**Mentor:** Mathew Blurton-Jones

Recent studies have strongly implicated the important role of microglia in the development and progression of neurological diseases such as Parkinson’s disease,
Amyotrophic lateral sclerosis, multiple sclerosis, and Alzheimer’s disease. Despite the widely accepted importance of microglia, methods to successfully generate microglia from pluripotent human stem cells have yet to be reported. In this study, we present a microglial differentiation protocol from induced pluripotent stem cells (iPSCs) and human embryonic stem cells (hESCs) as a method for obtaining microglia in order to study the role of the innate immune system in neurological diseases. Microglia are myeloid-lineage cells that arise from extraembryonic yolk sac erythromyeloid progenitors (EMPs) during early embryogenesis. Mimicking this development, we first generate hematopoietic progenitors cells (HPCS) from iPSCs/hESCs using an OP9-mouse stromal cell co-culture following previously established protocols. HPCS are then exposed to specific cytokines and growth factors identified to be important in microglia development. After 25–30 days, these microglia-like cells display microglia morphology, express microglia markers, and robust phagocytosis of fluorescent amyloid-beta. Gene expression analysis of microglia-like cells shows high expression of microglia-specific markers P2RY12, CX3CR1, and TREM2. Taken together, our data supports the microglia differentiation protocol established in this study.

**Kcene2 Deletion in Conjunction with a Western Diet Predisposes to Metabolic Syndrome in Mice**

Dara Nguyen  
*Mentor: Geoffrey Abbott*

Cardiovascular diseases (CVDs) remain the leading cause of death nationally and globally. Kcene2, a gene encoding a regulatory potassium channel β subunit, has been associated with a number of CVDs, and recent studies reveal Kcene2 deletion results in glucose intolerance in a mouse model. Because high-fat, high-sugar diets, described here as Western diets, are prevalent in modern society, individuals are now more likely to develop metabolic syndrome, a major risk factor for CVDs. The purpose of this study was to observe the effects of a Western diet in conjunction with Kcene2 deletion in the development of metabolic syndrome, and how this multisystem substrate causes individuals to be even more susceptible to CVDs in mouse model. We performed glucose tolerance and insulin sensitivity tests on Kcene2(+/+) and Kcene2(-/-) mice given either a Western or control diet. We also performed electrocardiograms (ECGs) and aorta isolations. Data from glucose tolerance tests and ECGs revealed that Western diet-fed mice were more likely to develop glucose intolerance and prolonged QT intervals respectively, and that this trend was more prominent in Kcene2(-/-) mice. Results from this study suggest a synergistic interaction between genetic and environmental factors in accelerating glucose intolerance, insulin resistance, and exacerbating Long-QT Syndrome (LQT). Because metabolic syndrome is a major risk factor for developing CVDs, it will be crucial to develop a better understanding of how Kcene2 deletion and western diets create an ideal and complex multifactorial substrate for metabolic syndrome to help develop more efficient methods of prevention and treatment for CVDs.

**Structural Studies of DsbA and its Putative Partner, VKOR, in Mycobacterium tuberculosis**

Katie Nguyen  
*Mentor: Celia Goulding*

Disulfide bond-forming (Dsb) proteins are essential for the correct folding and disulfide bond formation of secreted proteins. In *Mycobacterium tuberculosis*, DsbA is proposed to be a disulfide isomerase and is believed to be re-oxidized by its putative partner, vitamin K epoxide reductase (VKOR). The intent of this study is to further investigate the molecular determinants of the interactions between DsbA and VKOR by X-ray crystallography. In order to achieve this, DsbA crystals were grown in order to be soaked with a VKOR heptapeptide that binds with an apparent Ki of 2.9 μM. Co-crystallization screens of DsbA and the VKOR heptapeptide were set up and crystals were obtained. The cloning and protein overexpression of two different constructs of DsbA-VKOR fusion proteins was performed. I was able to successfully obtain crystals for DsbA alone and for the cocrystallization of DsbA with the VKOR heptapeptide. In addition, we believe that the DsbA-VKOR fusion protein was successfully overexpressed in a condition that resembles the overexpression conditions of full-length VKOR in *Synechococcus sp.*

**Role of PP2A in FTY720-Induced Down-Regulation of Nutrient Transporters**

Kimberly Nguyen  
*Mentor: Aimee Edinger*

Cancer cells are constitutively activated by oncogenes and depends on a large influx of nutrients to meet their high anabolic demands because of their rapid proliferation. When normal cells have limited access to extracellular nutrients, autophagy provides an internal source of nutrients and the cells become quiescent. In cancer cells, autophagy is reduced leading to a bioenergetic crisis and cell death. A sphingolipid-based drug, FTY720, down-regulates nutrient transporters in mammalian cells and effectively starves cancer cells to death. FTY720 is believed to trigger nutrient transporters loss through the activation of PP2A, a heterotrimeric serine-threonine phosphatase. PP2A levels are reduced in some cancer cells suggesting its role...
as a tumor suppressor. To determine if FTY720-induced nutrient transporter loss is a PP2A-dependent mechanism, different cancer cell types were treated with Calyculin A, a PP2A inhibitor. Cells were then treated with FTY720 and or its analogues and stained with antibodies conjugated with fluorescent dyes and analyzed by flow cytometry to measure surface levels of nutrient transporters. PP2A inhibition with Calyculin A partially prevented FTY720 or analog-induced nutrient transporter loss in some cancer cell types. From this, it is unclear how FTY720 still kills some cancer cells through a PP2A independent mechanism. Although FTY720 works effectively, it activates S1P receptors that triggers bradycardia in humans. By elucidating and understanding the molecular pathways by which FTY720 and its analogues target nutrient transporters, this can lead to developing S1P-inactive FTY720 analogue-based cancer therapy that can safely be used in human patients.

Analysis of FGF5 in Hair Growth Cycle and Subtype Sensitivity
Manda Nguyen

Mentors: Ji Won Oh, Maksim Plikus

The hair follicle is a microorgan that is present all over the largest and one of the most easily accessible organs to study in mammals—the skin. This organ contains progenitor cells that can be analyzed visually as well as molecularly in order to help elucidate signaling mechanisms in the integumentary system. Obtaining information on this particular feature of the skin can help scientists develop methods in order to cure alopecia, or baldness, as well as give crucial insight on similar progenitor cells that cannot be as easily studied, such as satellite cells, periosteum cells, and bone marrow stromal cells. Before analyzing single genes that partake in cell signaling in the integumentary system, wild-type skin and its timing of the hair cycle must first be studied as a control. The hair cycles consists of three stages: anagen (growing phase), catagen (degeneration), and telogen (quiescent phase). These stages are controlled by various activator and inhibitor signals. For this project, male murine hair cycle data were analyzed through consistent collections of their skin. A timeline was made through collection of mice skin in intervals of five days and conjectures were made based on evidence. It was found that their skin patterns tend to be symmetrical and are age-dependent. After P40, patterns become stochastic. Now that the control has been analyzed, other genes that act as activators and inhibitors of the skin can now be elucidated with this control data for the male integumentary system of mice.

Examining the Moderating Effects of Coping Mechanisms on Intimate Partner Violence of African American Survivors
Maria Nguyen
Mentors: Meeta Banerjee, Jacquelynne Eccles

Intimate partner violence (IPV) is a prevalent social issue that entails physical, sexual, and emotional abuse. African Americans, in comparison to Caucasians, are more affected by IPV in reporting more negative psychological effects such as depression, PTSD, suicidality, and substance abuse. However, those who receive social support are less prone to experiencing the psychological effects of IPV. This study examines whether the social support that victims of IPV received offsets the negative effects on their mental health. Using data from the Maryland Adolescent Development in Context Study (MADICS), this study investigated the relationship between IPV, mental health, and coping mechanisms in a sample of 164 African American young adults (ages 18–22). Participants reported on their experiences with IPV, their perceptions of support (e.g.,
Neural Stem Cells as Therapeutic for Huntington’s Disease Mechanisms of Action in Mouse Models
Phuong Nguyen
Mentor: Leslie Thompson

Huntington’s disease (HD) is an inherited autosomal dominant neurodegenerative disorder, indicated by motor and cognitive decline as well as psychiatric problems, and is caused by an expansion of a glutamine encoding repeat in the Huntingtin (HTT) gene. Atrophy of medium spiny neurons in the striatum is one hallmark of the disease. Stem cell transplantation into the striatum has the therapeutic potential to stimulate endogenous neurogenesis, replace atrophic neurons or aide both healthy and damaged cells by a “nursing effect” via trophic support. Transplantation of human neural stem cells (hNSCs) into the striatum of the R6/2 mouse model of HD resulted in an amelioration of motor deficits. Implanted cells survive, migrate and differentiate into mainly immature neurons and can be found within both the cortical and striatal regions. Preliminary results suggest that the mechanism of action of stem cell transplantation on HD modeled mice is through trophic factor support and not by cell replacement or stimulation of endogenous neurogenesis.

Impaired IP3 Calcium Signaling in Autism Spectrum Disorder
Rachel Nguyen
Mentor: John Jay Gargus

The purpose of this study is to analyze intracellular calcium release of inositol triphosphate (IP3) receptors of fibroblast cells in subjects with typical autism. Autism Spectrum Disorder (ASD) is a neurobehavioral disorder that includes a broad spectrum of individuals that share three characteristics: impaired social interactions, impaired language and communication skills, and restricted and repetitive behaviors. Recent studies have indicated that ASD is a polygenic disorder that may be a result of mutations in calcium channel subunits that disrupt calcium homeostasis and normal cell functions. Impaired calcium channel signaling, also termed “channelopathies,” is a hallmark of many neurobehavioral diseases and is of interest in studying molecular pathways involved in producing the autism phenotype. One such pathway, involving calcium release from IP3 receptors in endoplasmic reticula, showed that there was depressed calcium signaling in monogenic disorders, such as Fragile X and Tuberous Sclerosis subjects, with ASD in a previous experiment. In this study, the same technique was used to determine if a similar pattern of calcium release is observed in cell lines that express “sporadic” autism. We found that IP3-induced calcium release in skin fibroblasts from autistic patients was notably lower relative to their control counterparts. The data suggest that channelopathies associated with IP3 receptors may be used as a potential molecular marker and therapeutic target in ASD screenings.

Temperature Acclimation in Enzyme Kinetics of Neurospora discreta Strains
Richard Nguyen
Mentor: Steven Allison

With the increasing urgency of research into the effects of global warming and exposure of long-standing carbon pools on the planet, the importance of microbial decomposition of carbon sources in the soil by extracellular enzymes is apparent. The extracellular enzymes responsible for decomposition are expected to respond to the changing temperature because of the effect of temperature on enzyme kinetics. As part of the Allison lab’s larger research goal of introducing microbial systems to climate models, this study focuses on the acclimation of the filamentous fungus Neurospora discreta and how its enzyme kinetics change when it is grown at a warmer or at a cooler temperature. We hypothesize that enzymes from strains grown at a cooler temperature will be more temperature sensitive and will exhibit lower activity with increased incubation temperature. We used microplate enzyme assays to obtain the maximal rate of velocity ($V_{\text{max}}$) and half-saturation constant ($K_m$) for eight enzymes secreted by ten N. discreta strains. Although contrary to our initial hypothesis, we found evidence of temperature acclimation because the $V_{\text{max}}$ of several enzymes increased with increased growth temperature. Further experiments should look into the nature of the enzymes that are up-regulated and whether this trend is commonly exhibited in other decomposers.

Laser Speckle Contrast Imaging using a Consumer Grade Webcam
Thai Nguyen
Mentor: Bernard Choi

Laser speckle contrast imaging (LSCI) has been used in biomedical optics as a method to image blood flow. The term “speckle” is used to describe the random interference caused when coherent light strikes a specific
medium. When LSCI is applied to blood vessels, temporal fluctuations appear in the speckle pattern due to the movement of red blood cells, which causes a blurring in the speckle pattern. The amount of blurring can be quantified using image processing software and used to characterize blood flow. LSCI has been widely used in both clinical and research settings to image blood flow in the skin, the retina, and the brain. Recently, LSCI has shown to be able to provide clinicians with real-time feedback during laser therapy for port-wine stains. Compared to other conventional blood flow imaging techniques such as Laser Doppler flowmetry, LSCI can be performed with cheaper and simpler instruments, namely a laser, a camera, and a lens. As a result, LSCI is becoming an increasingly popular imaging method among both research groups and clinicians. Research groups have shown interest in scaling down the cost of LSCI even further in order for clinicians and laboratory groups to ease implementation. The objective of this project is to develop a low-cost LSCI device by using a webcam for image acquisition. This project could potentially increase adoption of laser speckle imaging into both research and clinical settings by driving down the cost for the LSCI imaging devices.

**Combinatorial Therapy with FTY720 Analogs and Small Molecule Inhibitors**

Tricia Nguyen  
*Mentor: Aimee Edinger*

During starvation, cells are normally able to survive by becoming quiescent, or dormant, relying on autophagy, or the destruction of other cells as fuel. In contrast, cancer cells generally are locked into a hyperactive growth profile that makes them less adaptive to nutrient deprivation. The Edinger lab is working on exploiting this difference in bioenergetics by mimicking starvation by down-regulating nutrient transporters on the surface with the sphingolipid drug FTY720 and its analogs. Our lab has shown that these drugs inhibit colon cancer growth *in vitro* and *in vivo*. An alternate cancer therapy selectively targets cancer cells by directly inhibiting mutated protein pathways that are responsible for driving cancer growth and survival. I tested our sphingolipid drugs in combination with small molecule inhibitors such as, trametinib and MEK1/2 (MEK1/2 allosteric inhibitors) and rapamycin (mTOR complex 1 inhibitor), in solid tumor cell lines to try to increase the potency and efficacy of our lab’s drugs. Viability IC50 values were determined by flow cytometry and MEK inhibition in combination with our analogs was found to dramatically decrease the survival of colon cancer cell lines, while the combination with rapamycin had no effect. In addition, both inhibitors increased the survival of non-transformed cells when treated with the sphingolipid drugs. This *in vitro* data suggests that MEK inhibitors combined with FTY720 analogs is a promising therapeutic strategy that can be tested *in vivo* in the future.

**Reconstruction of Border-Crossing, Long-Range Horizontal Neuronal Fibers in Rat Cortex**

Theodore Nieblas  
*Mentor: Ron Frostig*

The sensorimotor cortex is generally considered to be a parcellated entity, based on localized differences in cytoarchitectonic staining and studies of peak evoked neuronal activity. However, it has been discovered that point stimulation of a single whisker in an adult rat elicits a border-crossing, long-range horizontal activity spread that radiates symmetrically from the point of stimulation in addition to evoking peak activity in the relevant barrel of the barrel cortex. Analysis of histologically stained sections of the cortex following tracer injections of adeno-associated virus (AAV) expressing GFP under the direction of a permissive cytomegalovirus promoter has revealed neuronal fibers radiating away from the site of the injection that appear to correspond with the activity spread. For the present study, an AAV vector employing a different promoter, calcium-calmodulin dependent protein kinase II (α subunit), which is only expressed in the cortex, was used in order to elucidate if the radiating neuronal fibers were cortical or sub-cortical in origin. This experiment used photomicrography to reconstruct fibers across these sections from the injection site to their respective terminal fields. Fibers were reconstructed radially from the injection site and are shown to effectively ignore cortical borders, crossing deeply from the barrel field into multiple cortical territories, showing that these axons are cortical in origin.