UNIVERSITY OF CALIFORNIA

The Twelfth Annual Summer Undergraduate Research Symposium

Friday, August 3, 2018

12th Annual
Summer Undergraduate Research Symposium
August 3, 2018

Overview

8:00 AM - 8:20 AM	Presenter's Check-In & Breakfast in COB1-105
8:30 AM - 9:00 AM	Welcome in COB1-120
9:15 AM - 12:00 PM	STEM Poster Sessions*
9:30 AM - 11:30 AM	SSHA Presentations**
12:00 PM - 1:00 PM	Lunch pick-up in *COB1-105* *For presenters and faculty/research mentors*
1:00 PM - 2:45 PM	SSHA Poster Sessions*
1:00 PM - 3:30 PM	STEM Presentations**

Posters & Presentations are concurrent. Check scholar overview for more details.

***Poster Sessions Located in KL 355**

9:15 AM - 10:00 AM	*STEM Poster Session A*
10:15 AM - 11:00 AM	*STEM Poster Session B*
11:15 AM - 12:00 PM	*STEM Poster Session C*
1:00 PM - 1:45 PM	*SSHA Poster Session D*
2:00 PM - 2:45 PM	*SSHA Poster Session E*

****Oral Presentations on Second Floor of COB 2**

9:30 AM - 11:30 AM	*SSHA Presentations*
1:00 PM - 3:30 PM	*STEM Presentations*

Coffee Room in COB2 - 267
Open from 8 AM - 3 PM
(*open to all guests)*

ASPIRES
Accelerated STEM Pathways through Internships, Research, Engagement, and Support

UROC Undergraduate Research Opportunities Center UC MERCED

UROC-H UNDERGRADUATE RESEARCH IN THE HUMANITIES

CCBM NSF-CREST CENTER FOR CELLULAR AND BIOMOLECULAR MACHINES

aps American Physiological Society

MACES MERCED NANOMATERIALS CENTER FOR ENERGY AND SENSING

SURE SUMMER UNDERGRADUATE RESEARCH FELLOWSHIP

UC LEADS

WELCOME TO THE TWELFTH ANNUAL

UCMERCED

SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM

AUGUST 3, 2018

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UC Leadership Excellence Through Advanced Degrees (UC LEADS)

The following student scholars are part of the University of California Leadership Excellence through Advanced Degrees (UC LEADS) Program. The goal of the UC LEADS research and graduate preparation program is to educate California's future leaders by preparing promising students for advanced education in science, technology, engineering and math (STEM) fields. The program is designed to identify upper-division undergraduate students with the potential to succeed in these disciplines, but who have experienced situations or conditions that have adversely affected advancement in their fields of study.

For more information, please visit http://uroc.merced.edu/uc-leads

Creating Solid-State Hydrogels Utilizing Conjugated Polymers

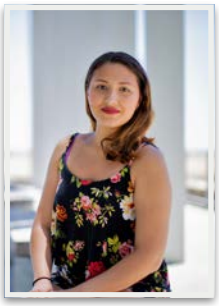
Miguel Flores Martinez, Robert Jordan, PhD, and Yue Jessica Wang, PhD
School of Engineering, University of California, Merced

Conjugated polymers are a class of materials that exhibit excellent electrical and mechanical properties that uniquely complement traditional metals conductors. To date, a large number of applications that utilize conjugated polymers have been reported, but their inclusion in complex micro scale objects is still in infancy. We have designed a system which allows for the creation of conjugated polymer containing hydrogels with good dimensional. Specifically, we have developed a novel resin for use in stereolithography (layer-by-layer 3D printing) that created complex hydrogels consisting of poly-2-acrylamido-2-methylpropane sulfonic acid (PAMPSA) and poly(ethylene glycol) dimethacrylate (PEGDA). After washing and swelling we demonstrate that the conducting polymer polyaniline (PANI) can be successfully grown with in the gels using an interfacial polymerization method. These gels display a 10 fold drop in resistance compared to gels without PANI. This type of material can potentially diminish pollution of inorganic material.

Accelerating Chemical Reactions using Light and Gold Nanoparticles

Anthony Garcia, Hnubci Vang, Ziliang Mao, PhD, and Son Nguyen, PhD
School of Natural Sciences, University of California, Merced

Catalysts are often used to speed up chemical reactions to help satisfy our large demand for manmade materials and natural resources. Unfortunately, most industrial catalysts only work at extreme reaction conditions such as high temperatures and elevated pressures. To alleviate these issues, we are working on a catalyst that can be used at ambient conditions when exposed to light. Our catalyst, which we denote as a photocatalyst, consists of colloidal gold nanoparticles (GNPs) in an aqueous solution. We developed a model reaction between iron ion (Fe^{3+}) and the GNPs so that we can expand our understanding of the catalytic mechanism of this photocatalyst. The data collected indicates that smaller GNPs will catalyze the reaction faster because a particle with a smaller surface area will have more light-activated electrons in the particles that can advance the reaction. This result enabled us to expand the scope of our study into organic reactions; which lead to the successful catalyzed conversion of styrene into ethylbenzene and 4-nitrophenol into 4-aminophenol. Our study demonstrates the effectiveness of GNPs as a photocatalyst under mild reaction conditions. Continuing efforts will be made to optimize the conditions of our photocatalyst for future study and applications.



Using Random Walkers to Build Marine Aggregates

Barbara Gomez-Aldrete, Camille Carvalho, PhD, and Francois Blanchette, PhD
School of Natural Sciences, University of California, Merced

Marine snow or marine aggregates are large collections of microorganisms. Those microorganisms can begin at the ocean's surface and some eventually land on the ocean floor, forming aggregates along the way. Marine snow helps bring carbon down to the ocean floor, therefore, providing an essential contribution to the carbon cycle. Understanding how marine aggregates form could help us get valuable insight about the oceanic carbon cycle. This project focuses particularly understanding how microorganisms aggregate. To do so, the mathematical model we consider are random walkers. Random walkers are mathematical objects that take steps randomly based on predetermined rules. We developed a Matlab code to simulate the microorganisms as random walkers with various sets of rules, and observe the resulting aggregates. Through numerical simulations we will be able characterize the speed of aggregate formation, and the shape of the aggregates. We will provide statistical descriptions of the aggregates as a function of their size and as a function of the various conditions in our code.

Effect of Temperature on Optical Particle Counter

Christian Lopez Garcia, and Ashlie Martini, PhD
School of Engineering, University of California, Merced

Fully formulated oils are used to prevent metal to metal contact in machinery. These oils contain a variety of additives such as foam inhibitors, viscosity index improvers, and detergent agents. Foam inhibitor additives reduce the foam build in oils. The lower the foam build up, the more separation there is between the lubricating pieces. This comes at the cost of perceived cleanliness, because foam inhibitor droplets are detected by optical particle counters that detect particulates; which have the potential to cause wear. In this research the goal is to measure particle count data, and use that data create a formula that can predict the particulate counts at varying temperatures. Also, to extrapolate this data to predict particle counts at other temperatures and on other instruments. Two separate particle counters were used to test 8 oil samples. Each oil had a different concentration of foam inhibitor and was tested at temperatures ranging from 20 °C to 60 °C on both optical particle counters. Results showed that oils starting at higher particle counts tend to decrease as temperature increases. Oils starting at low particle counts increase in particle counts as temperature increases. At intermediate particle counts, the measurement did not vary with temperature. This data can potentially be used to create a standard to compare the effectiveness of foam inhibitors measured at different temperatures.

Investigating the Ability to Estimate the Population Mutation Rate Under Neutral Evolution

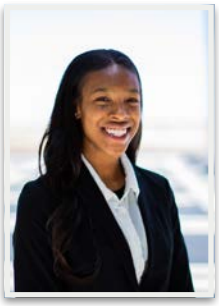
Hansell Perez, and Suzanne Sindi, PhD
School of Natural Sciences, University of California, Merced

Population genetics considers differences in the gene sequences of present-day individuals. Common forces impacting genetic variation are drift, mutation and selection. Selection favors beneficial sequences, and thus decreases variation. Similarly, drift decreases genetic variation by promoting fixation of neutral genes. In contrast, mutation introduces changes to gene sequences and thus is the dominant force that increases genetic variation. The population mutation rate (θ) is one of the most fundamental parameters in genetics and ecology. Because we cannot directly observe mutations, numerical methods have been developed to estimate θ directly from present-day genetic sequences. These procedures estimate θ to be the expected value of a theoretical evolutionary process. However, less work has been done to understand the variance and accuracy of these estimators. In this work, we investigate the accuracy of a common estimator for θ through forward simulations inspired by the Infinite-Sites Model (ISM) introduced by Kimura in 1969. Our Multiple-Sites Model simulates the evolution of a gene of finite length in a population of N individuals under drift and mutation. We estimate θ by using the total number of alleles (versions of the gene present) and the number of segregating sites (positions in the gene which differ between individuals). We study the variation in our ability to estimate θ as a function of the gene length, population size and time.

ISO Code and Temperature in Base Oil and Foam Inhibitors

Angelica Pineda, and Ashlie Martini, PhD
School of Engineering, University of California, Merced

Tribology is the study of friction, wear, and lubrication. Lubricants decrease the amount of wear in mechanical component systems. Foam inhibitors are used to decrease the quantity of foam in the lubricant base oil. However, foam inhibitors are also detected by optical particle counters so perfectly clean oils with foam inhibitors can appear dirty. Different quantities of silicone foam inhibitor are added to base oil and the samples are then blended together. Afterwards, the number of particles per millimeter is determined using two test instruments and two particle counters. These test instruments differ by the ability of one to allow filtration. Both rigs are exposed to different temperature levels. It was found that both particle counters displayed similar characteristics for temperature and particle counts. Which leads us to the conclusion that there is a correlation between measured particle count and temperature.



Development of Gravity-Guided 3D Muscle Formation: A High Throughput Tissue Engineering Technique

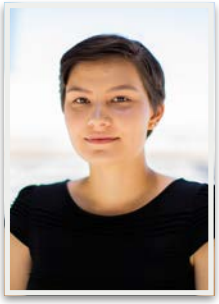
Ariell Smith, Rachel Hatano, and Kara E. McCloskey, PhD
School of Engineering, University of California, Merced

Cardiovascular disease is a leading cause of death in both the United States and many developed countries. These high mortality rates stem are complicated by the heart's limited regenerate capability following acute ischemia or myocardial infarction. Tissue engineering has ushered in new techniques to generate patient-specific cardiomyocytes for cell replacement therapies. Among the more widely adopted methods is the formation spheroids of cardiac muscle cells using hanging drops, microwells, or cell culture agitation. Our studies aimed to diversify the potential applications of gravity-guided self-assembly of cells. C2C12 mouse myoblast cells were suspended in 40μL droplets at concentrations of 5,000, 10,000, and 20,000 cells/mL. Results show that cells filtered through 70μm pours form relatively uniform tissue spheres that increase in area respective to initial cell concentration. While these protocols are capable of efficiently producing uniform cell spheres for high throughput applications, they lack the ability to scale-up tissue size or control more complex tissue shapes. Future work will use the optimized on human induced pluripotent stem cell derived cardiomyocytes. We will also construct more complex tissue strips and rings while analyzing for cell shape, organization, and density for tissue uniformity.

Summer Undergraduate Research Fellowship (SURF)

The following student fellows are part of UC Merced's Summer Undergraduate Research Fellowship (SURF) Program. SURF is a fellowship that is offered to all undergraduate students in any discipline. This 9-week summer fellowship offers our students the opportunity to work alongside faculty and graduate student mentors and provides graduate school preparation.

For more information, please visit http://uroc.ucmerced.edu/surf



The Diversity and Vector Potential of Merced County Mosquitoes

Jocelyn Acosta, Eunis Hernandez, Ryan Torres, and Andrea Joyce, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

This project examines the diversity of mosquitoes in Merced County by evaluating the ecology of 11 different mosquito species and by identifying their vector potential to transmit various diseases. Currently, there is no guide to specifically identify the mosquitoes that are found in Merced County and their vector potential to transmit multiple diseases. Analyzing the various mosquito types in Merced and categorizing the habitats each mosquito is found in will provide information for the public and contribute to the public health of Merced County. This project will survey different habitats that could be potential breeding sites for different mosquitoes. The EVS mosquito trap which uses CO2 and an attached light source will be used to attract mosquitoes. The collection sites will be mapped. Mosquitoes that are trapped will be identified according to species. From each collection site, the proportion of each mosquito species will be determined. In addition, literature has been reviewed to determine the vector potential of each mosquito. By determining the diversity of mosquitoes in different habitats in Merced County, a field guide can be produced in order to interpret the significance of vector control as well as provide a summarized review of different mosquito types and their ability to transmit disease. With the risk of mosquito-borne diseases, it is important to investigate the mosquito populations found within Merced County.

3D Printable Conducting Polymers for Wearable Electronics

Israel Alberto, Ian Hill, Victor Hernandez, and Yue (Jessica) Wang, PhD
School of Engineering, University of California, Merced

Wearable electronics require conformability to the human body, with matching stiffness as the skin and must be able to stretch to accommodate body movement. Metals are the most commonly used electrically conducting material for these applications. A major drawback using metal conductors is their inability to withstand high strain without losing conductivity. Metal conductors are also difficult to recover and recycle. To address these issues, we have developed a conductive polymer composite that is able to withstand high strain while maintaining its conductivity, and is easy to recycle, requiring only water. Our composite contains polyaniline doped with poly(2-acrylamido-2-methyl-1-propane sulfonic acid) to increase ductility, poly 3,4-ethylenedioxythiophene:poly(styrene sulfonate) to increase electrical conductivity, and an ionic liquid as a plasticizer and dopant. Pastes can undergo elongation up to 250% and has an electrical resistance of 7 Ω. These composites can be easily recycled and reprocessed in water, then 3D printed into customizable circuits or flexible electronic devices using a direct write assembly technique.

Establishing Ex-Vivo Model System for Studying Cardiac Repair Mechanisms in Regenerative Medicine

Mohammed Amwas, Anley Tefera, MS, and Kara McCloskey, PhD
School of Engineering, University of California, Merced

One in every four deaths in the U.S. is caused by cardiac diseases. A main focus in cardiac research is developing model systems for studying cardiac repair mechanisms and pathology. Myocardial tissue slices provide a multicellular and functionally intact ex-vivo model system for cardiac research. Tissue slices are usually produced with a thickness of 100-400 µm, allowing the diffusion of oxygen and metabolic substrates to maintain their viability. However, due to the lack of mechanical loading and electric stimulation in cultured myocardial tissue slices, cardiomyocytes tend to remodel and lose their contractility, starting in their first day in culture. We plan to establish methods for preparing highly viable porcine myocardial tissue slices and maintaining their viability and functionality over long period that can extend to months. Applying mechanical stimulation on the tissue slices allows them to maintain their viability and functionality over longer time. We obtained a pig's heart from a slaughterhouse and cut 400-500 µm thick myocardial tissue slices using Leica VT1000 S microtome. The tissue slices are cultured on a liquid-air interface. The slices will be loaded in a device that provides cyclic biaxial mechanical stimulation during the culturing period. We expect superior viability and functionality in the loaded tissue slices. The viability and functionality of the cardiomyocytes are tested using viability staining and calcium transient testing, respectively.

Bridging China with Merced: Chinese Economic and Spatial Development, 1870-1990

Verenize Arceo, and David Torres-Rouff, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Highway 99 is considered an urban development that drastically changed the spatial dynamics of Merced, California. When construction took place in 1960, developers conceded that the location of the highway would serve as a fixed point connecting Merced to larger areas within California. However, the manipulation of the space in favor of the highway, deconstructs our understanding of a vibrant Chinese community that had made that space home for over 70 years. By examining Merced County's census records, county tax assessment rolls, and fire insurance maps, these archival documents reveal that although the vibrant nature of this community is lost, its significance still exists. I argue that through their labor, land occupation, and tax monies, Chinese contributed significantly to Merced's growth, development, and diversity. Moreover, Chinese developed their own social, cultural, and spatial landscape to bridge the gap between these two competing worlds: their ancestral ties to China and their physical ties to Merced. Continued research will seek to create an online database that will aid in historical memory concerning Chinese residents in the Central Valley. Furthermore, this project will allow for a deeper analysis in the formation of spatial presence, power, and identity that Chinese residents constructed literally on the "other side of the tracks" in Merced.

Identifying Natural Killer Ly49 Clusters Post Tumor Cell Killing

Julia Beale, Alberto J. Millan and Jennifer O. Manilay, PhD
School of Natural Sciences, University of California, Merced

Natural Killer (NK) cells are innate immune lymphocytes that kill virally infected and cancerous cells, by releasing perforin and granzymes. NK cells express Ly49 surface receptors, which are involved in distinguishing healthy from unhealthy cells. The "Summation Hypothesis" suggests that the sum of NK cell intrinsic signals, upon engagement of Ly49 activating and inhibitory receptors will dictate killing of a potential target by the NK cell. Despite Ly49 receptors' known role in controlling NK cell activity, the Ly49 receptor combination leading to optimal target cell killing is unclear. We developed a computational approach to identify clusters (populations) of WT NK cells with differences in expression of activating Ly49H and Ly49D and inhibitory Ly49I and Ly49G2 receptors in the presence and absence of $\beta 2m^{-/-}$ cell targets. Using viSNE, a high-dimensional data reduction algorithm, we identified 10 distinct clusters with varying Ly49 receptors and frequencies. We found a significantly increased frequency of NK cells with a $Ly49H^{-}$ $Ly49D^{-}$ $Ly49G2^{-}$ $Ly49I^{-/+}$ profile in the presence of targets. Alternatively, NK cells with a $Ly49H^{+}$ D^{+} $G2^{+}$ $I^{-/+}$profile were significantly reduced, surprisingly indicating a lack of target cell killing associated with this profile. This unbiased approach should help identify NK cells expressing the ideal Ly49 receptor repertoire for killing cancerous cells, and has possible applications in NK cell cancer immunotherapies

Modeling Two Distinct Populations by Way of Two Separate Networks with Varied Inter-Connectivity and Its Effect on Language Competition and Language Death

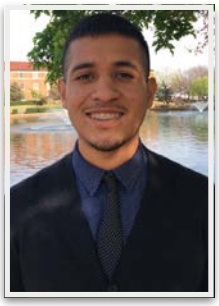
Roberto Bernal, and Paul E. Smaldino, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

We model language competition between an endangered linguistic community and a larger linguistic community. Abrams and Strogatz developed a mathematical model that models language competition between two monolingual populations. Their model looks at the aggregate behavior of the whole population and predict that over time one language dies while the other acquires all the speakers. Minett and Wang extend this model by incorporating bilingualism and social structure. They model the social structure by way of networks. Whilst their model also shows that language death is inevitable, they are able to achieve language maintenance by changing model parameters. They further implement and agent-based model to examine the likelihood that the system converges to different states. We extend their model by modeling two separate networks representing two distinct populations. We vary the inter-connectivity between both networks and examine its relationship to language maintenance. We use NetLogo for the agent-based model and to make the networks. Our results show that language maintenance is more likely to be achieved when two separate networks are less inter-connected. This implies that when there are two separate linguistic communities, the endangered language is more likely to be maintained if there is a large degree of isolation between their community and the larger linguistic community.

DMAP1 Regulates Cell Fate Decisions of Cells Containing Genomic Instability Along the Anterior Posterior Axis

Andrew Betancourt, Paul Barghouth, Salvador Rojas, and Nestor Oviedo, PhD
School of Natural Sciences, University of California, Merced

DNA damage can lead to the development of various life-threatening diseases including cancer or ultimately fatality. In fact, stem cells that replicate with DNA damage are the culprit behind 90% of cancer related deaths. We seek to identify the role of DNA Methyltransferase 1 Associated Protein 1 (*DMAP1)* in DNA damage repair and tissue regeneration in the planarian model organism *Schmidtea mediterranea.* Current literature suggests *DMAP1* is a critical component of the NuA4 histone acetyltransferase complex which is recruited during DNA damage in the repair process. Moreover, *DMAP1* plays an important role in DNA damage double stranded breaks. Similarly, *DMAP1* regulates the activity and function of the ATM response mediator, which is responsible for halting the cell cycle for DNA damage repair. Additionally, reduced expression of *DMAP1* leads to chromosomal instability and tumorigenesis. Here we show knockdown of *DMAP1* results in inhibition of DNA damage repair. Furthermore, overtime the knockdown also leads to differences in DNA damage repair over the anterior posterior axis which is down regulated by the Wnt/beta-catenin signaling. We also see hyperproliferation of stem cells containing DNA Damage. Together, we suspect *DMAP1* to be the epigenetic regulator that maintains the Anterior Posterior axis in planarian.



Music Memory Hours

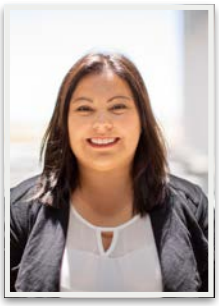
Sergio Cabrales, and Jayson Beaster-Jones, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Last summer (2017), I argued that Music Therapy is not just a resource that provides socializing and entertainment for elderly, it is a health intervention that uses music as an element to address, maintain, and promote emotional, social, and cognitive needs of individuals. This summer 2018 project is an extension of last summer project. By interviewing with healthy aging adults on their musical memories, we can establish a generalize study about the relationship of music and memory as we age. The method includes playing musical samples that are solicited from participants in group and individual interviews, collection of a particular memory associated with that sample, and data entry into the MEAM Central database. I will provide before and after surveys that will provide information on the participant's overall mood. I hypothesize that this method of music memory will have positive emotional and therapeutic use for both caregiver and patients. This information will be used as a baseline for future research in professor Beaster-Jones and Janata Labs.

Testing Solar Modules for use in AIPV Applications

Javier Chaname, Aaron Wheeler, and Sarah Kurtz, PhD
School of Engineering, University of California, Merced

Solar powered cars are a sustainable alternative to gas powered cars, but there have been many problems with implementing the solar panel in a car in a practical way. We want to understand the performances of a variety of solar modules on a car roof or variety of environments. We tested Gallium Arsenide solar modules side by side with silicon solar modules by laying them on a black box, simulating the roof of a car, and see which solar module would be ideal to place in a car. Temperature and power output of the solar modules as well as environmental conditions will be collected. We aim to quantify the performance of various solar modules as a function of operating conditions.



Social Relationships and Type 1 Diabetes Management in Early Emerging Adulthood: Help or Hinderance?

Gloria Chavez, Avia Gray, MA, and Deborah Wiebe, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Early emerging adulthood (ages 18-25) is the time of development when Type 1 diabetes management (T1DM) is the poorest. It is theorized that this may reflect various social transitions and changing social resources at this time of life (e.g., moving away from parents; managing T1D in new academic and professional environments). However, little is known about the social contexts that help or hinder T1DM at this high risk time. The present pilot study had 29 emerging adults with T1D complete a survey and qualitative interview. Parents and romantic partners were the most trusted social resources with 59% stating parents and 35% stating partners are most counted on for help with T1DM. Parents (48%) and partners (24%) were also the most common sources of criticism, while friends (31%) and parents (17%) made T1DM more difficult. Thematic coding of the qualitative interviews is in progress to understand how parents, partners and peers may help (e.g., provide reminders, emotional and instrumental support) or hinder T1DM (e.g., over-react; offer unhealthy foods; distract from T1DM), and how emerging adults may better utilize their social resources (e.g., disclose about T1DM to solicit help when needed. Findings may identify factors that can guide interventions to better support T1DM in early emerging adulthood.

Analyses of Two-Dimensional Horizontal Flowing Soap Thin Films

Merari Cisneros, Jesse Sanchez, Krishna Shah, PhD, and Yanbao Ma, PhD
School of Natural Sciences, University of California, Merced

Two-dimensional flow analyses initially resulted in inconclusive data due to their complex designs. Through the work of Mysels, Couder, and Basdevant it was shown that the thin film of water trapped within the amphipathic molecules of soap were a good model to follow. Since then various studies have been conducted on vertical flowing soap films propelled by gravity or by other forces in horizontal set ups. In this study, a horizontal soap film of varying dimensions is established using a braided polymer line as the injection point. The injection point feeds the soap film onto a mobile guide wire system consisting of nylon fishing line to establish a uniform flow of soap film. The apparatus culminates in a collection reservoir of the used soap solution. Using Laser Doppler Velocimetry (LDV) and other techniques we can determine the flow velocity. With the flow velocity, the viscosity throughout the film can be determined using either the relation between Reynold's number and Strouhal's number or Schlieren Imaging to quantify the turbulent flow in the film. Constructing models of two-dimensional flow from soap films can provide the groundwork for the study of more complex two-dimensional fluids such as the lipid bilayer.

Collaborative Childcare with Privacy Protection

Mugdha Dhungana, Stephanie Dubé, and Lisa Yeo, PhD
School of Engineering, University of California, Merced

Childcare services are difficult to obtain for UC Merced affiliates; an app to help connect people has been proposed as one way to alleviate these pressures and enable sharing of both child related goods and services. We are interested in understanding the privacy and security concerns of individuals who may benefit from this application, so that we can incorporate protections during application development. We believe that users will be more concerned about privacy protections in the context of childcare than they would be with the sharing of household goods and services. Interviews of parents and caregivers were used to get an initial state of privacy concerns for the application and text analysis. Based on the text analysis, we develop a journey map that will showcase the user interface and help understand the functionality and usage of the app. We have analyzed the various user needs and implemented it into the journey map along with the security and privacy considerations. The journey map will allow for better understanding of the application development. We will collect application usage data to examine patterns of behavior to see how various demographic factors affect parents' safety priorities.

Ethers as H Atom Donors in Palladium-Catalyzed Transfer Hydrogenations Mediated by Tetrahydroxydiborane

Huong Do, Jocelyn Ochoa, Ixchel B. Gonzalez, and Benjamin J. Stokes, PhD
School of Natural Sciences, University of California, Merced

Transition metal-catalyzed transfer hydrogenation is commonly used to reduce functional groups in organic molecules. We previously reported a method to reduce alkenes and alkynes using stoichiometric water and tetrahydroxydiborane at ambient temperature and pressure. In the course of these studies, we found that tetrahydrofuran (THF) can also serve as an H atom donor under similar conditions. The stoichiometric use of ethers as a metal hydride source is not well established, and would permit a safe and simple hydrogenation method compared to direct hydrogenation with hydrogen gas. Such a method could also be used to reduce water-sensitive compounds. Our efforts to optimize, evaluate the breadth, and understand the mechanism of this reaction are described below.

Collaborative Childcare: Identifying Priorities

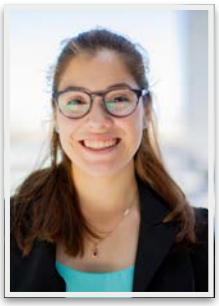
Stephanie J. Dubé, Mugdha Dhungana, and Lisa Yeo, PhD
School of Engineering, University of California, Merced

Childcare services are difficult to obtain for UC Merced affiliates; an app to help connect people has been proposed as one way to alleviate these pressures and enable sharing of both child related goods and services. We are interested in understanding the privacy and security concerns of individuals who may benefit from this application, so that we can incorporate protections during application development. We believe that users will be more concerned about privacy protections in the context of childcare than they would be with the sharing of household goods and services. Interviews of parents and caregivers were used to get an initial state of privacy concerns for the application and text analysis. Using NVivo we analyzed the qualitative data to identify themes for application development and that of people's privacy and security concerns while examining correlations between users concerns and their demographics. This information will serve as the foundation to create the journey map for the application development. We will collect application data to examine behavioral and security patterns as part of a longer-term study.

Political Framing (Without) Effects: An Optimistic Reconsideration of Rationality and Democratic Competence Using Equivalency Frames

Emily Fishburn, and Stephen Nicholson, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

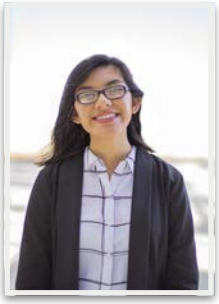
The literature surrounding “framing effects” has cultivated interest in the fields of sociology, psychology, and political science. According to the works of both political scientists and political psychologists, “framing effects” can reveal the way in which cognitive biases lead individuals to systematically judge certain political options as more favorable (if they were presented positively) than other logically equivalent options (if they were presented negatively). These appropriately named “equivalency frames” are often presented in terms of either perceived “gains” or “losses”. Existing work suggests that individuals will make risk-averse choices in response to the perceived assurance of gains and, conversely, display risk-seeking behavior in response to perceived losses. In this experiment, three equivalently framed questions regarding “economic inequality” and “economic equality” were delivered in a survey to nearly 1,000 participants using the online survey platform, QualTrics, and Survey Sampling International (SSI). Using the Statistical Package for the Social Sciences (SPSS), responses were analyzed to determine the strength of frames and the potential significance of respondent party identification. Neither framed “losses” nor “gains” presented any statistically significant effects on respondents. These results are inconsistent with the bulk of prior research, suggesting that either the influence of these frames were not as strong as others, or perhaps individuals are not as susceptible to the influence of framing as previously thought.



How Student Learning Preference Affect Learning Outcomes

Jocelyn Galdamez-Melendez, Maria D. Dueñas, MA, and Tanya Golash Boza, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

This research aims to study the effectiveness of videos on learning on race and racism and how students' preferences affect learning outcomes. Previous research has found that students have learning preferences that allow them to better understand new concepts. Perceived learning preferences shape video-and text-based learning outcomes because students understand and obtain more information when their learning preference is incorporated into the classroom. Two groups were tested in this study. One group was tested through the use of a video and the other group was tested through reading the script of the video screening. Students were asked to answer questions to measure how well they understood the material discussed in the video or script. Both groups were asked about their learning preference: learning through videos, learning through readings, a combination of both, or other. The results showed that 65.9 % of students preferred the combination of both text and video. 54.5% of students scored higher using text compared to 45.5% of students watching the video. These results suggest that videos which incorporate text would allow students to better comprehend course material by exposing students to both text and visual learning styles. These results coincide with previous studies done. Students learn more when their learning preference is taken into consideration.



The Effects of Biosolids on Plant Growth and Water Quality in Merced County

Fatima Gamino[1], Yocelyn Villa[1], and Rebecca Ryals[2], PhD
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Efficient nutrient cycling in agricultural systems is associated with improved carbon storage, reduced leaching, and improved yields. Soil organic matter is the driving force of nutrient management in a sustainable agroecosystem. Biosolids are a nutrient-rich form of organic matter produced during the treatment of municipal wastewater. Our objectives were to determine short- and long-term effects of biosolids amendments on nutrient loss to water. In this experiment, soil samples were collected to a depth of 10 cm from a ranch in Merced County. The site includes an agricultural field that has been treated with biosolids for 20 years and an untreated control area. Barley was grown in six treatments which included: the control and long-term treated soils, as well as both with added composted biosolids, and both with added fresh biosolids. The incubation included weekly irrigation events to test for loss of nutrients (nitrate, ammonium, and phosphate) through leaching. Effectiveness of biosolids amendment on plant growth was determined by plant height in each of the samples. The presence of composted biosolids in the samples was shown to increase the soil water-holding capacity. These results suggest that a sustainable approach to agriculture through the addition of organic matter, like biosolids, increases plant yields while minimizing nutrient losses to groundwater.

Land, Sustainability, Exploitation: National Land for People and Agribusiness War Over the Reclamation Act of 1902

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The 1902 Reclamation Act is one of the greatest land reform and agrarian U.S. federal statutes because it began the dramatic transformation of arid sections of the American West by providing federal help for irrigation projects. The irrigation supplied by this act intended to stimulate the economy, by decreasing unemployment specifically for farming families, and promoting healthier rural communities. This law attempted to achieve these goals by establishing the requisites of a 160-acre land limitation and residence requirement. However, owners of large landholdings found ways around these requirements, amassing most of the rich land in the west Fresno area, known as the Westlands Water District (WWD), leaving family farmers without any land to cultivate. By taking an in depth look through National Land for People archives which included newspaper articles, and congressional records, press releases, and maps, my findings reveal that approximately during the years of 1960-1986 political battles existed between the National Land for People and corporate landowners from the WWD. The conflict between the two was the result of the Reclamation Act being violated. In conclusion, this project closely examines the exploitation that private farm workers faced by agribusiness aficionados and sheds new light on the previously ignored efforts made by farm worker activists to enforce this Act.

The Relationship between Social Support and Depression across Ethnicity

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Social support is related to lower depression. Yet, it is unclear if this relationship holds similarly true for Hispanics and non-Hispanics. Also, social support can come from different sources, such as one's friends and one's family, that may differentially relate to depression. The purpose of this paper is to examine the relationship of family and friend social support with depression and to test whether this differs across ethnicity. Participants across the U.S. were recruited via Amazon's Mechanical Turk and surveys were completed using Qualtrics. Participants included 202 women and 232 men (aged 20-71 (M = 36.51, SD=11.12), with 51 Hispanics and 382 non-Hispanics. Depression was measured using the Center for Epidemiologic Studies Depression Scale (CES-D) and social support was measured using the Social Support Appraisals (SS-A) scale. We found negative correlations between social support and depression in both Hispanic and non-Hispanic samples, indicating that the more social support one receives, the less depression one reports. However, there is a stronger negative correlation in Hispanics than non-Hispanics. Perceived family social support was similar to perceived social support. As in past studies, we also found that social support was related to depression. Interestingly, we found as predicted that this relationship was stronger for Hispanics than non-Hispanics. We might want to pay special attention to social relationships and support as a possible treatment for depression in Hispanics.

Optimizing Anemometer Location Onboard a sUAS to Better Localize Methane Leaks in Gas Pipeline Industry

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The applications of small unmanned aircraft system (sUAS) have become an increasingly popular instrument across several industries. In conjunction with NASA Jet Propulsion Laboratory (JPL), sUAS could be especially useful in detecting methane leaks in natural-gas pipeline industries. This requires placing weather measurement devices near the flight location. However, having that grounded weather station can offer data disparity in wind speed and direction measurements caused by multiple external influences (i.e. buildings and trees). This can change the direction of the wind carrying the plume of methane and affect calculations. Therefore, integrating a mini ultrasonic anemometer with NASA JPL's methane sensor on-board a sUAS can better assist in quantifying and localizing gas leaks in a time varying three-dimensional space. In doing so, we examine the flight dynamics of the pitch, roll and tilt of the quadrotor's propellers and its effects on anemometer readings to better integrate the wind sensor onboard the sUAS.

Mass Incarceration and Gentrification in Washington DC

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This mixed-methods research project explores the relationship between mass incarceration and gentrification in Washington DC. The data for this study include federal court cases and newspaper articles related to drug offenses and drug gangs between 1985 and 2000 – the height of the War on Drugs. These qualitative data allow us to create a narrative that provides insight to the laws and policies that led to an increase in incarceration in Washington, DC. a narrative of evil men to justify the increasing arrests, and that the federal government targeted black men with zealous enforcement and prosecution. We then use quantitative data to explore subsequent racial and economic changes in the city. Using 1990 census and 2015 American Community Survey data we used ArcGIS to map trends in racial and class-based change in the city. A layering of street gang headquarters onto this map reveals that areas heavily targeted by federal law enforcement agents have gentrified. This preliminary research will be paired with interviews, content analysis of city budgets, and agreements with federal agencies in order to go more in depth into identifying correlations between the increase of incarceration and gentrification.

Alteration of the Alpha-5 Helix Affect KaiA-KaiB-KaiC Cooperative Interactions in the Circadian Clock of Cyanobacteria

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The circadian oscillator in cyanobacteria is generated by the interaction of three proteins: KaiA, KaiB, and KaiC. Together, these proteins generate a 24-hour rhythm of KaiC phosphorylation, which is stimulated by KaiA during the day and is inactivated by KaiB at night producing a synchronized phosphorylation rhythm. The α5 - helix connecting the N- and C-terminal domains of KaiA was previously believed to act as a linker region that did not play a role in generating circadian rhythm. However, it has been revealed that KaiA undergoes a large conformational change from its active (day) to inactive state (night), which involves the displacement of the α5-helix from N-terminal to C-terminal domain. We hypothesize that the binding affinity of the α5-helix to its N- and C-terminal domains change as a function of temperature, thereby regulating the active and inactive states of KaiA in an oscillating reaction. To understand how the α5 - helix binds to the N- and C- terminal domains of KaiA, we isolated and cloned the α5 - helix in order to mutate residue 156 from leucine (L) to alanine (A). This mutation has been shown to weaken its interaction with KaiA's C-terminal domain. We will be using fluorescence polarization experiments to measure binding affinities of the wild-type and mutant peptide to KaiA's N- and C-terminal domains at various temperatures.

Detecting Inflammation in Hematopoietic Stem Cells in a Sclerostin Deficient Microenvironment

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Sclerostin (Sost) is a protein secreted predominantly by osteocytes that inhibits bone formation by blocking Wnt/β-catenin signaling and activation of osteoblast function. The loss of sclerostin results in increased bone formation. As Wnt signaling is also important for hematopoietic stem cell (HSC) maintenance and self-renewal, we hypothesized that the loss of Sost in the bone microenvironment would influence HSC fate. Our studies indicate that loss of Sost in the bone microenvironment induces a myeloid bias in downstream production of progenitors. This increase in the myeloid lineages is indicative of inflammation, the rapid immune response to cellular damage, in upstream hematopoiesis. Our goal is to confirm if inflammation is present in a sclerostin-deficient bone marrow environment and understand how it affects hematopoietic stem cells. Using both wild type (WT) and sclerostin knockout (SostKO) mice, we quantified the expression of known inflammatory genes *Pu.1*, *Cebpβ*, and *Batf2* by using qPCR. We hypothesize that increased expression of these genes will correlate with hematopoietic inflammation in a sclerostin-deficient microenvironment.

Developmental Perturbation Alters Neonatal Immune Function

Eric Lebish, April C. Apostol, and Anna Beaudin, PhD
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B1a cells are a fetal-derived subset of B-lymphocytes that are predominantly located in the peritoneal cavity (PerC) and are known to mediate tolerance and provide a rapid response to infection via the production of natural antibody, Immunoglobulin M (IgM). Our lab recently identified a novel, developmentally restricted hematopoietic stem cell (drHSC) that exists only during late fetal development and gives rise specifically to B1a cells. We have further shown that developmental perturbation during fetal life leads to an expanded population of B1a cells in postnatal life. Here, we evaluated the consequences of expanded B1a cells after developmental perturbation for immune function. We hypothesized that IgM concentration would increase in offspring following developmental perturbation. To test this, we perturbed fetal development by administering a single injection of the viral mimetic, Poly (I:C) (20 mg/kg), into pregnant females at embryonic day 14.5 and collecting PerC lavage fluid and serum from the pups three weeks later at postnatal day 14. We then quantified antibody levels in PerC lavage fluid and serum using ELISAs. Our preliminary results reveal that developmental perturbation specifically increased IgM in the PerC of offspring, consistent with an expanded B1a cell population. Future studies will address how changes to antibody repertoire affect response to infection. These findings underscore how perturbation of early hematopoietic and immune development drives functional changes to immunity across the lifespan.

Electrochemical Desalination Cell

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Desalination is a process that removes salts (e.g. sodium chloride) from water. Around the world there is rapid expanding scarcity of fresh water. Desalination technology holds significant potential to increase potable water availability. One attractive approach to desalination is the use of electrochemical reactions to remove ionic solutes. This method mimics the action of various batteries (e.g. lead acid) that deplete electrolyte components (e.g. H+ and SO4-) during charging. Within this research we consider a symmetric electrochemical cell with silver as both cathode and anode that is used to remove sodium and chloride ions from solution near one electrode (while simultaneously enriching the solution near the other). We construct a flow cell to extract the purified water from this electrode configuration and explore the operational parameters for optimal salt removal.

Pesticide and Acute Asthma Attacks in California, USA in 2005 to 2008: A Bidirectional Symmetric Case Crossover Study

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California is the leading producer of agricultural commodities. In 2015, 213 million pounds of pesticides were reported to be used in the agriculture industry. Previous research has shown that inhalation of pesticides has been linked with respiratory diseases. Two of the most used pesticides in California are methyl bromide (MeBR) and 1, 3-dichloroprophene (1,3-DCP). These two pollutants have been speculated to cause respiratory disease, therefore we hypothesize that they have the ability to act as intense asthma triggers. In this study, a bidirectional symmetric case-crossover method was applied to examine the data obtained from Emergency Department visits for asthma occurrence and EPA emissions data for methyl bromide and 1,3-DCP within the study area. We observed that the odds ratio for MBR and CDCP are positively associated with the asthma ED visits only in the cold seasons. We also found a positive association between MBR and CDCP and asthma ED visits among African Americans and Hispanics. Further research is needed to address the effects of pesticides on our health in order to implement policies on training, better air monitoring of toxic organic compounds, and resources for those affected.

The Importance of having a Usual Source of Dental Care in Stanislaus and Madera County

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This research project examines access to usual sources of dental care and time since last dental visit in Madera and Stanislaus County, which are health provider shortage areas, and have a significant proportion of their population enrolled in Denti-Cal. 79 adult participants were recruited from June-July 2018. Demographic and oral health information was collected via a self-administered survey. Participants were asked “Do you have a dentist?” and “how long has it been since your last trip to the dentist?”. I triangulated our data against the California Health Interview Survey (CHIS). In Madera county 56.4% of respondents reported a usual source of care, while 53.9% reported having visited the dentist in the last year. In Stanislaus County 55.0% of respondents reported that they had a dentist, while 60% reported that they have visited the dentist within the past year. CHIS reported that 67.2% responded visited the dentist within the past year in Madera County and for Stanislaus County it was 62.7%. A higher percentage of respondents in both counties do not routinely visit the dentist or have a dental home. Both a usual source of care, and routine visits are needed for effective oral care.

Effects of Arl13b truncated construct on hedgehog signaling in 3T3 stable cell lines

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The primary cilium is a single non-motile sensory organelle that projects from the cell surface and plays a critical role in signal transduction. In recent years, it has been recognized that dysfunction in the primary cilium can lead to a class of disorders known as ciliopathies. Mutations located in the primary cilium have been found to disrupt signaling pathways such as sonic hedgehog which is crucial for embryonic development and are the cause to various neurological defects. We plan to identify the ciliary proteome specific to neural stem cells in the developing mouse brain through TurboID, and determine roles of ciliary proteins in neurogenesis and neural migration in the embryonic brain. Arl13 (BADP-ribosylation factor-like 13B) localizes in ciliary membrane and is specifically expressed in the primary cilium in the developing cortex. We find the smallest Arl13b construct NRVEPPR can target the primary cilium in the instantaneously transfected 3T3 cells in our previous study. To further study the effects of different truncates of Arl13B on hedgehog signaling, we generated different truncates of Arl13B stably expressed cell lines. We quantified cilia length and we didn't find any difference between NRVEPPR and control. Given that Smo and Gli2 are the important effectors of hedgehog signaling, next we will examine the effect of different truncates of Arl13B on their localization in the cilia.

Development of Direct-Ink Writing Apparatus for Conjugated Polymer Extrusion

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Conventional direct-ink writing (DIW) technologies typically rely on Archimedes-screw based pressure generation systems common to commercially available clay extrusion 3D printers. We have developed a new material containing conjugated polymers which displays high elasticity, water solubility, self-healing characteristics, but also low pH, which is incompatible with commercial extrusion systems. Need for an extrusion system capable of handling low pH, or otherwise corrosive materials with high viscosity, is evident. Here we develop a pneumatically-fed auger extrusion device that is low cost, chemically inert, and extrudes viscous fluid at high pressure, allowing for a print fidelity below 200 microns. The apparatus is fully implemented on the commercially available fused deposition modeling (FDM) printer, the Prusa i3 Mk2s. Herein, we will detail reducing dead-space with a smaller auger, increasing pressure generation and component longevity by modifying surface finishes and coatings, and employing modularity that allows for device implementation onto competing 3D printing systems.

How Effective Are Videos in Enhancing Student Learning Compared to Reading Text?

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Previous research has shown that videos help students maintain engagement, while helping them retain information better through the use of video techniques such as signaling, segmenting, and weeding. Based on the prevailing literature, Andrea hypothesized that videos promote active learning compared to reading text. Andrea conducted her research study to assess the effectiveness of videos on learning about race and racism. The first group were tested through the use of reading a script based off of a video screening. The second group were tested through the use of a video. After students finished, they were asked to answer eight questions to measure how well they understood the material discussed in the script or video. She was able to compare both groups and determine which group understood the material better. The average score from the text group was 54.5%, compared to students from the video screening group who scored 45.5%. Students who watched the video screening did not understand the material as well as the students who read the script. Race and racism can be a difficult topic to understand through videos because it is a controversial topic. Videos may enhance student learning to an extent, but they have limitations. These limitations may be addressed through improving the videos. For example, signaling, segmenting, and weeding may enhance student learning.

Early immune perturbation may increase susceptibility to asthma

Lorena Moreno Aguilar, Diego Lopez, April C. Apostol, and Anna Beaudin, PhD
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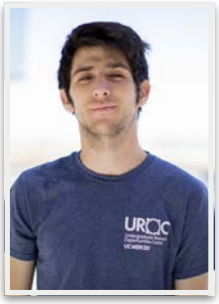
Components of the adult immune system are only specified during fetal development. However, the impact of perturbation during fetal development on immunity across the lifespan remains unknown. Our lab has previously shown that maternal perturbation during development alters the establishment of a fetal-specific hematopoietic stem cell and its innate-like lymphocyte progeny into adulthood. These data identified a “critical period” during development in which the adult immune system is shaped by extrinsic factors. We investigated how immune perturbation in utero affects susceptibility to allergic airway inflammation (AAI) after exposure to house dust mite (HDM) allergen. Innate lymphoid cells (ILCs) are a subset of innate-like lymphocytes that secrete cytokines in response to infection. Group 2 ILCS (ILC2s) are found in the lung and are an early source of IL-5 and IL-13 cytokines during AAI. We hypothesized that immune perturbation during the “critical period” increases susceptibility to AAI in offspring compared to saline controls. Following acute HDM sensitization, we quantified numbers of ILC2s, mast cells, eosinophils, and neutrophils in the lung of perturbed offspring. Preliminary results revealed remodeling of the lung immune landscape in neonates following developmental perturbation. However, preliminary analysis revealed no significant increase in AAI, suggesting our HDM sensitization protocol may require additional modification for neonates. Results from these experiments will reveal the mechanism by which early immune perturbation affects disease susceptibility in adulthood. Previous research has shown that videos help students maintain engagement, while helping them retain in adulthood.



Latin X Well-Being

David Olson, Jacqueline Hua, and Jennifer Howell, PhD
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Adjusting to college life is difficult but adjusting as a Latinx student appears to be even more challenging. Latinx students face unique challenges such as the cultural adjustment to their new environment. These unique challenges take their toll on the physical and social wellbeing of these students. One way to observe this cultural adjustment is to look at the social eating behaviors of the students in the dining halls of college campuses and examining correlations between social adjustment and whether these students were eating alone. Previous research has shown that eating alone is a predictor of depression amongst individuals. For this study, data was collected in a larger study investigating the relationship between acculturation and dietary intake. Participants were recruited from the Yablakoff-Wallace Dining Center at the University of California, Merced to complete two online surveys. The participants consisted of 76 undergraduates who were primarily female (51%), Latinx/Hispanic (67.6%), first-year students (47.5%), and an average age of 19.63 years old (SD = 2.02). This study found that being Latinx/Hispanic was a predictor of greater social support, but also worse physical health status along with a greater expectation that it will get worse over time. Latinx/Hispanic students seem to also make food decisions that are not beneficial to health, even though they believe that they are making healthy food choices. Future research should seek to answer or explain this phenomenon amongst Latinx/Hispanic students.

Investigating the role of Sept9a in Endoderm Formation

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Congenital and inherited malformations of the digestive tract debilitate an organism's ability to live and perform normal functions. The digestive tract is derived from an embryonic tissue called the endoderm. Previous results showed that the gene *septin 9a* (*sept9a*) is highly expressed during endoderm formation, however the contribution of *sept9a* to this process is unknown. Septins are cytoskeletal proteins that are found in the cell cortex where they function as scaffolds. Compared to other cytoskeletal proteins like actin and microtubules, little is known about septin function. We hypothesize that *sept9a* plays a critical function in endoderm morphogenesis and gut development. Here, we used CRISPR/Cas9 to create *sept9a* mutations in zebrafish in order to gain a better understanding of the gene's role in endoderm formation. For our first approach, we used CRIPSR/Cas9 to create a large deletion in the *sept9a* gene. In a second approach, we used CRIPSR/Cas9 to knock-in a premature stop codon by homologous recombination. Utilizing genotyping methods, we have identified 10 F0 zebrafish carrying germ line transmission of *sept9a* mutations. We are currently raising offspring of some of these zebrafish. Future studies will determine if these mutant zebrafish have altered endoderm morphogenesis compared to wild type zebrafish. These studies will give us a greater understanding of both gut development and septin function.

Quantification of Wnt signaling pathway genes in VHL cKO mice

Hawa Padmore, Betsabel Chicana, MS, and Jennifer O. Manilay, PhD
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Studies have shown that deletion of Von Hippel-Lindau (Vhl) in bone cells stimulates bone formation through the stabilization of hypoxia inducible factors (HIFs). Bone formation is a process that involves three bone cell types: osteoblasts, osteocytes and osteoclasts, which maintain homeostasis by respectively building, retaining, and breaking down bones. Osteoblasts and osteocytes are derived from mesenchymal stem cells and differentiate in response to Wnt signaling. Wnt signaling is also involved in bone growth and breakdown through regulation of osteoclasts, and the osteoblast-to-osteocyte transition. Osteocyte-specific conditional Vhl knockout (VhlcKO) mice display dysregulated bone growth and high bone density. The mechanism in which Vhl depletion impacts the expression of Wnt signaling target genes in osteocytes has yet to be uncovered. This study will analyze the expression of Wnt signaling target genes Tcf7, Lef1, c-Myc, and Axin-2 in the VhlcKO. Osteocytes were extracted through serial digestion of femurs and tibias from mice and gene expression measured by quantitative PCR. We hypothesize that Vhl deletion in osteocytes disrupts bone homeostasis by causing decrease in Axin-2 and an increased expression of Tcf7, Lef1, and c-Myc. These results will reveal a mechanism in which Vhl deletion in osteocyte cells lead to an increase in bone mass specifically through the Wnt signaling. Future directions include incorporating Wnt antagonists such as, DKK1, SFRP1, and SOX9, to further understand this mechanism.

Osteocyte targeted VHL deletion effects on HIFa pathway genes

William Pratcher II, Betsabel Chicana, MS, and Jennifer O. Manilay, PhD
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Von Hippel-Lindau (VHL) disease causes the development of tumors in organs which is caused by a missense mutation of the Vhl gene which leads to dysregulation of cellular oxygen levels. In normoxic conditions, propyl hydroxylase-domain proteins (PHDs) hydroxylate hypoxia-inducible factor alpha (HIF1a), allowing VHL protein to target it for degradation. In contrast, during hypoxia, PHD gene expression increases while its catalytic activity is inhibited, and VHL protein is inactive, resulting in HIF1a accumulation and activation of target genes in the nucleus. Hypoxia is highly associated with bone formation and accelerated transformation of osteoblasts-toosteocytes. Mice in which VHL is specifically depleted in osteocytes (VhlcKO) display increased in bone mass, and defects in immune cell development. Our goal is to characterize the role of hypoxia related genes in the VhlcKO to further understand the role of hypoxia in bone development and homeostasis. Osteocytes were isolated through bone digestions to extract RNA and gene expression of hypoxia related genes measured by quantitative-PCR (qPCR). I hypothesize upregulation of PHD2 and PHD3 while PHD1 remains constant in the VhlcKO in response to changes in the microenvironment. Understanding the role of PHDs in this model will further elucidate the role of hypoxia and the HIF pathway in angiogenesis, osteogenesis and immune cell development. Next steps includes analyzing erythroprotein (EPO), which is a target gene for pVHL and counteracts hypoxia.

The Role of Immediate Early Genes in the Development of Ethanol Tolerance

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Alcohol is the most widely abused drug, yet the molecular mechanisms involved in simple behavioral adaptations like tolerance, preference, and reward are still not well known. Drosophila develop lasting ethanol preference and tolerance after a single ethanol exposure, allowing us to easily study neuronal adaptations. Regulation of gene expression in the nervous system by acute ethanol likely contributes to this plasticity. We previously showed acute ethanol exposure induces transient expression of Hr38 and other immediate early neuronal activity genes. Ethanol activates the Mef2 transcriptional activator to induce Hr38, and the Sirt1 histone/protein deacetylase terminates Hr38 to promote tolerance. Improper regulation of Hr38 by Ethanol in Sirt1 nulls causes decreased tolerance so the question imposed is if immediate early gene termination is important for tolerance development. Understanding how Mef2, Immediate early genes, and Sir2 coordinate in specific neurons to change ethanol responses in circuitry critical for learning, memory, and sleep will help in defining how drugs can co-opt brain functions to lead to dependence and addiction

Gentrification in Washington, D.C : A Mixed-Methods Comparison of Two Census Tracts

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Within the past 20 years, Washington D.C's neighborhoods have undergone demographic and economic transitions as a result of gentrification (Jackson, Jonathon. 2015). Gentrification refers to a temporal and spatial process of renovation and reinvestment that benefits the well-off middle-and upper middle-class population. The purpose of this project is to use Qualitative Google Street View to observe the panoramic views of blocks within census tracts of interest, in an effort to determine if gentrification is captured in Washington D.C. Using mixed methods, I compare Google Street View with Census data, and create a comparison of the quantitative and qualitative measures of gentrification. Using Jackelyn Hwang's Google Street View Gentrification Observations Supplementary Material as a reference, I created an excel spreadsheet containing 31 codes and a short description for each. Using these measurements, I proceeded to code 10 blocks from a gentrified census tract and 10 blocks from a non-gentrified. Results indicate qualitative Google Street View captures gentrification in Washington D.C through visible signs of public reinvestment in public space, in the aesthetics of a neighborhood and signs of efficacy to counter visible physical disorder that discourage reinvestment in a neighborhood. As the research suggests, the influx of higher socioeconomic status households into low income neighborhoods directly and indirectly alters the culture and composition of a neighborhood.

Depositing lipid membranes on pollen particles for studies of lipid phase separation

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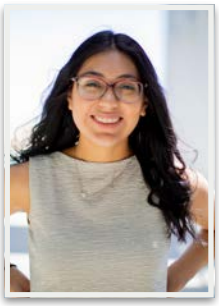
This report includes the study of pollen grains as a biologically available microscopic structure to support lipid membranes. The outer sporopollenin surface that covers a pollen grain is a polysaccharide that in theory, should be able to support a lipid membrane. The complex topology of the pollen grains surface should also help separate the Liquid Ordered (Lo) and Liquid Disordered (Ld) domains found in the lipid mixture used for the experiments. Direct deposition of a lipid mixture onto pine sporopollenin was performed. Confocal microscopy imaging can help identify the successful addition of lipid mixture onto pollen grains. If the pollen particles topography is able to induce phase separation, the surface of the grains can be used to tailor lipid membranes with specific properties for further studies and research. While the pine pollen grains were able to support a lipid membrane, phase separation was not observed during these experiments. Exploring other options for depositing the lipid mixture onto the pollen grains (solvent exchange for example) or using a different lipid mixture may help get phase separation of the domains.



Auditory and Visual Rhythm Perception & Synchronization

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A number of studies suggest there are multiple timing systems within the brain. Further evidence indicates that the dorsal auditory stream connects the auditory cortex to the motor cortex through the posterior parietal cortex, which plays a role in rhythm perception. This dorsal stream is also involved in visual and tactile rhythm perception, suggesting the idea of a common timing system tied to the motor system. Given the evidence of multiple neural timing systems and the common role of the motor system and dorsal stream in both auditory and visual rhythm perception, we hypothesize that performing a motor synchronization task to a rhythm will modify the neural timing mechanisms involved in rhythm perception in both auditory and visual modalities. To investigate this, electroencephalogram (EEG) was used to record brain wave data while participants were tasked to passively entrain to, and finger tap in synchrony to separate visual and auditory rhythms. Preliminary findings show that the frequency bands of entrainment shift from higher frequencies (beta-band) to lower frequencies (delta-band) over the parietal cortex when subjects synchronize their movements to the visual rhythms. This finding provides further evidence of multiple timing mechanisms involved in rhythm perception and that the mechanisms utilized will shift depending on the task.

The Efficacy of Antimicrobial Blue Light on *C. albicans* Biofilm

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Candida albicans is a normal commensal of the human microbiota, but it is also one of the most common fungal pathogens of humans. The most serious *C. albicans* infections occur in immunocompromised individuals and in patients with medical devices. One facet that makes *C. albicans* and other fungal microbes more complicated to combat compared to bacteria is that, like humans, they are also eukaryotes. As such, the extensive repertoire of antibiotics that we have developed does not work against fungi, and the few existing classes of antifungals have high human toxicity. Furthermore, *C. albicans* can form complex and drug resistant biofilms that make *C. albicans* particularly challenging to treat. Here, we test the efficacy of an alternative therapeutic, antimicrobial blue light therapy, against *C. albicans* biofilm development. Short-term blue light therapy does not cause damage to human cells, however there is some evidence that it may have antimicrobial properties. We utilize three different *in vitro* biofilm assays to assess the effects of blue light therapy on *C. albicans* biofilms. Our findings indicate that blue light therapy can induce a significant reduction in biofilm thickness when used during the first 24h of biofilm formation. These results suggest that blue light therapy may be useful as an alternative antifungal agent.

Music Makes You Smarter: Impacts of music on academic performance in school aged children

Angelica Soza, Alexander Khislavsky, Meaghan Altman, and Jeffrey Gilger, PhD
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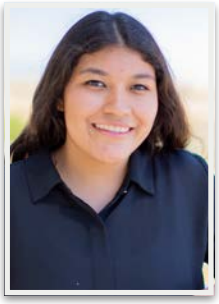
Structured activities combining intrinsic motivation and purpose have been found to promote positive academic and social outcomes in young children. Evidence also shows that unstructured activities amongst children led to lower social interaction. The long-standing claim that “Music makes you smarter” has mixed results to support it; the gap in the literature is that most evidence to support this hypothesis is correlational, very few of the studies are longitudinal, and young children are rarely subjects. This study analyzes the NCES ELCS K-4 dataset and uses mixed model repeated measures ANOVAs to evaluate the impact of participation in music influence outcomes longitudinally. Annual participations in musically engaging extracurricular activities served as the between groups independent variables. Performance on measures of math and social skills, over time, were the outcome measures. Biological sex of volunteers was used between-groups covariate in the ANOVA. Analyses revealed that over time there is a moderating effect of math exposure on children’s math performance and ability. Results show differences in math scores depending on how much music exposure a child received and further analyses show differences between biological sex and math performance. These results can help support why children should have exposure to extracurricular activities in order to assist in development.



Mineralocorticoid Receptor (MR) Antagonism in the Renin-Angiotensin-Aldosterone System Temporarily Reduces Hypertension

Stacy Tletlepantzi, Ruben Rodriguez, PhD, Manuel Cornejo, PhD and Rudy Ortiz, PhD
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According to the Centers for Disease Control and Prevention, 75 million people have a high systolic blood pressure, including children. Many factors contribute to the development of high blood pressure, among the primary factors is the inappropriate activation of the renin- angiotensin- aldosterone system (RAAS). Inappropriate activation of the RAAS increases sodium reabsorption in the kidneys, however, whether the increase of sodium reabsorption correlates with hypertension is not known. Therefore, we hypothesize Ang II induced rats increases systolic blood pressure, except when a mineralocorticoid receptor (MR) antagonist is present. To test this hypothesis, we measured Na^+ and K^+ excretion at various times in the following groups of Sprague- Dawley rats: (1) control, (2) angiotensin II infused (Ang II; 80 ng/min x 28 days), (3) Ang II + angiotensin receptor blocker (ARB), (4) Ang II + mineralocorticoid receptor blocker (Epl), and (5) Ang II + ARB + Epl (combo). Once the urine levels are tested, our expected results should demonstrate low excretion of Na^+ and high levels of K^+ in Ang II infused rats. In the presence of ARB, high levels of Na^+ will be excreted than K^+. The same results are expected for Epl and ARB + Epl groups. Epl treated rats will exhibit reduced amounts of Na^+ reabsorption which will temporarily reduce systolic blood pressure in Ang II infused rats.

Considère's Construction Reconsidered

Annaliza Torres, and Christopher Viney, PhD
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Considère's construction, named after the French engineer who first suggested this approach in 1885, offers a graphical method of determining the stress that, if exceeded, will lead to runaway deformation (necking and rupture) of a material. The method is widely cited in textbooks and the research literature, and is commonly applied to polymers as well as the metals for which it was originally developed. However, the limitations of the construction, and the validity of applying it to materials other than iron and steel, are not discussed. Also, there are alternative approaches to determining the stress under which a material will neck, given the modern computational and plotting resources that were not available in Considère's day. In our project, we assess the accuracy and usefulness of Considère's method and alternatives for predicting the mechanical behavior of materials.

Turbulence in Cross-Flow Generated by 2 Stage Compressors

Luis Torrijos, Adrian Villegas, and Jian-Qiao Sun, PhD
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A two-stage air compression method capable of creating turbulent flow resulting from crossflow is developed for the application of crashing agglomerations of nanoparticles. Turbulence can be beneficial in some applications and hazardous in others. In the present application, turbulence will create random collisions of agglomerations and help nanoparticles mix well with air to form fine mist for application in the agricultural and food industry. Our design comprises a storage unit, 2-stage centrifugal compressors that mimic aircraft engine design, split diaphragms that guide the air flow from one compressor to the other, a chamber of heating rods that serve the purpose of heating the air and creating turbulent flow.

The Immigration Legislation Context for Immigration Detention and Family Separation

Debora Villalvaza, and Ma Vang, PhD
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Immigration within the U.S. regarding refugees, asylum seekers, and immigrants is a complicated and controversial issue. Given the previous policies, laws, acts, and executive orders enacted by the state, the U.S. government deals with immigration in a negligent, dehumanizing manner. The history of government management of immigration contains serious issues, such as the criminalization and fear of deportation for refugees and immigrants, the lack of sufficient health care, the difficult process of navigating through the legal system, and the separation of families. Through analyzing immigration legislations such as the Supreme Court Case, *Reno v. Flores* and a Congressional hearing titled *Crossing the Border: Immigrants in Detention and Victims of Trafficking Part I and II*, this paper shows the systematic difficulties in place affecting immigrants. This study finds that many immigration legislations have a detrimental effect on immigrants, such as health care, time spent in detention, and the separation of families. It is crucial to understand the impact of such legislations, especially over time within the U.S.in order to improve humanitarian and legal conditions regarding immigrants.

World Learning in Virtual Reality: The effects of space on novel word learning

Alondra Wences, Timothy M. Shea, Chelsea L. Gordon,
and Ramesh Balasubramaniam, PhD
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Sensorimotor interaction enables language learning and is assumed to serve as a basis for conceptual representations. However, there is a need of support for the early stages of embodied word learning. To address this, a gamified word learning experiment was developed in virtual reality. Participants learned the names of six novel objects with distinct colors and shapes by interacting with them while facing a set spatial direction; half of the objects could be manipulated with the left hand, and the other half with the right. Through trial and error, participants learned the object names. Afterwards, a word-color match task was completed. There were 4 blocks, half being completed facing the same direction in which the words were learned and the other half being completed facing the opposite direction. We expect to find that when facing the same direction as that during learning, participants will respond more quickly to right-hand words with their right hand. When rotated, however, participants will be quicker to respond to left-hand words with their right hand. This may suggest that the position of the body plays an important role when it comes to the early stages of embodied language learning. Moreover, this may support theoretical views of language that focus on sensorimotor experiences being a foundation for word representations.

Identification of Appropriate Arl13b Construct for Targeting Embryonic Radial Glia Primary Cilium *in vivo*

Whitney Williams, Xiaoliang Liu, and Xuecai Ge, PhD
School of Natural Sciences, University of California, Merced

Ciliopathy, or cilium dysfunction, leads to many pediatric structural brain defects that confer life-long effects on impacted individuals. Primary cilium is the sensory unit of cells and is responsible for sending and receiving signals to control cellular processes. In the case of the developing embryonic brain, primary cilia of the radial glia control developmental processes based on the signals received from the embryonic environment. Historically, research in this area has been stagnant because the physical isolation of the primary cilium was necessary for analysis making the job nearly impossible. We plan to identify the ciliary proteome specific to neural stem cells in the developing mouse brain through TurboID and determine roles of ciliary proteins in neurogenesis and neural migration in the embryonic brain. Arl13 (BADP-ribosylation factor-like 13B) localizes in ciliary membrane and is specifically expressed in the primary cilium in the developing cortex. Our goal is to find the smallest Arl13b construct possible that can be fused to the TurboID ligase for targeting the primary cilium of the radial glia cells of the embryonic developing brain so that we can use it as the bait protein to screen some new ciliary molecules. We electroporated different Arl13B truncates into E15 brains and we'll quantify and analyze the effects of different truncates of Arl13B on the neuronal migration and neurogenesis of embryonic brain.

Unmanned Ground Vehicle for Water Leaking Detection

Ricky Yan, Teibiao Zhao, Haoyu Niu, and YanQuen Chen, PhD
School of Natural Sciences, University of California, Merced

The Unmanned Ground Vehicle is considerable the next generation of agricultural gadgets. Rather than using archaic method to manually search for leaks, my project is aiming to replace past archaic method. Utilizing multiple dynamic image-processing techniques like optical flow, Gaussian Mixture Model, and computer vision to detect pipe leak. From all above method, optical flow is the most efficient and accurate. The result of the project will be placed on UGV and autonomously navigate through way-point by Mission Planner and the PixHawk Autopilot System.

Scholars in the 2018 Summer Undergraduate Research Institute cohort journeyed to San Fransisco to visit the California Academy of Sciences.

Undergraduate Research in the Humanities

The following students scholars are part of UC Merced's Undergraduate Research in the Humanities (UROC-H) Program. The goal of the UROC-H program is to engage a cohort of 10-15 promising undergraduate students each year in faculty-mentored research and prepare them for advanced education in the humanities and humanistic social sciences.

For more information, please visit http://uroc.ucmerced.edu/uroc-h

Water, Jobs, and Politics: Farmerworkers of Fresno County's Westlands Water District

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School of Natural Sciences, University of California, Merced[1];
School of Social Sciences, Humanities, and Arts, University of California, Merced[2]

California's Central Valley contains some of the richest agricultural land in the entire world, producing a quarter of the nation's food. The Westlands Water District (WWD), located in the southwest of the San Joaquin Valley, produces various crops on a plot of land roughly the size of Rhode Island. In this district, primarily composed of agricultural land, water deliveries affect what can be grown and when, influencing the labor force. Utilizing WWD archival records, census records, Bureau of Labor Statistics data, and congressional records, this study investigates the influences water deliveries and relevant legislation have on the growth of the farmworker population. Despite fluctuations in the farmworker population, no trend or relationship between population growth and water deliveries was found; however, these random fluctuations could indicate economic depressions, immigration policies, and agricultural legislation that affect this specific group aside from water deliveries. That is why it is important to continue to investigate what additional factors influence the growth of the farmworker population in agricultural regions similar to Fresno County.

Living Black In the Field of Brown

Nonzenzele I. Aldonza, and Whitney Pirtle, PhD
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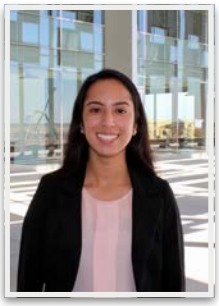
A study measuring graduation rates shows that only 70 percent of black students at UC Merced graduate as compared to comparable public research institutions and other public universities. What could we attest to these findings? In 2014 we opened a living learning community built on pillars of mentorship, community outreach, and academic workshops. Additionally, we asked for contact information of the prospective black students to start formulating a relationship with them prior to them coming to campus. After the establishment of Afro Hall, it was discovered that black students retention rates increased, becoming the highest of any single demographic group on campus. That data illustrated a direct correlation between increased support, and performance. After conducting focus groups with black students about their black experience both in Afro and on campus, that information was used as the primary data. Secondly, interviewing the institutional supporters was vital information to provide a unique experience. In conclusion, the typical student who steps into AFRO are students seeking that community away from home but also a student who absorbs all the information that is given to them. This data will help us advocate for more black student spaces on campus

Demographics of the Migrant Education Program

Diana Alvarado, and Robin DeLugan, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

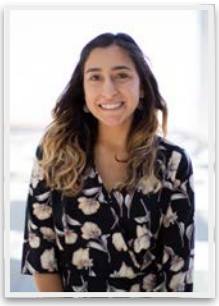
The purpose of this project is to highlight the achievements of the Migrant Education Program (MEP) with the migrant farmworker community in the Central Valley. Fresno MEP IV has one of the highest funded programs in the state of California and largest population of qualified students. As the migrating community is reshaped every year by the seasons and crops, the question remains how MEP establishes itself in the community in order to influence its targeted population, especially “special populations” such as the children of Mexican indigenous farmworkers, a linguistically and culturally diverse growing California population. How is this special population acknowledged in statistical and other program data? The methodology used to collect the data involved newspaper articles, published reports, along with archives that highlight the policies that helped establish the program and the role it has played for the state of California and Fresno area. Collective data of past and present students, requirements from the children of members of the community, and summer school specifically targeting migrant students from all over the state. Within the findings, results showed a gap in the demographical data of the program which it is yet unclear whether this has caused an impact in the area.



The Production of New Corridos as a Response to the Current Immigration Crisis in the U.S.

Natalia Alvarado, and Patricia Vergara, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Corridos are narrative songs that are composed and consumed within a transnational circuit across the Mexico-U.S. border, as well as in other Latin American countries. Corridos speak on everyday occurrences and on a variety of issues important to their communities, a practice going back to nineteenth-century rural Mexico. Topics about immigration and feelings of displacement while crossing the border, as well as living in the U.S., have been common themes. Historically, the border has been a place of friction, with corridos about immigration struggles often arising when there is increased political conflict. The goal of this study is to shed light on a new crop of corridos that is emerging as a response to the current immigration crisis in the U.S. With the current Trump administration, a number of corridos have been created to share the experience of crossing the border and life in the U.S., as well as highlighting the current political environment. Two songs analyzed in this study are: Calibre 50's "El Corrido de Juanito," speaking on the displacement felt by being an immigrant in the U.S., and Los Tres Tristes Tigres' parody song "La Jaula de Trump," speaking on the consequences of new immigration reforms. These songs expose the immigrant experience within the U.S., which are not often revealed in U.S.'s history books.



The Lingering Effects: Family Members of the Incarcerated

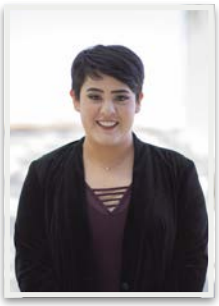
Olivia Alvarez, and Tanya Golash-Boza, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

This study examines the effects and consequences of incarceration on incarcerated people and their family members. Most studies of the collateral consequences of incarceration focus on children, with less focus on the experiences of the family members as a whole. This study fills the gap by examining both the perspective of family members and their significant hardships. Interviews were conducted in order to observe and collect experiences and effects of incarceration on family members. A total of ten interviews was completed with family members who had a loved one currently or formerly incarcerated. The study was able to capture similarities and differences from the responses of the interviewees. Findings revealed that the 3 factors that impact family members are: stigma, emotional and behavioral effects, and financial difficulties. The results collected will help provide solutions to these ongoing issues in order to create better financial solutions and emotional support for family members and provide education to those who are not aware of the negative externalities that come with incarceration.

Incarceration and Reentry: Unpacking Stigma and Rehabilitation

Angelica Costilla-Mancha, and Tanya Golash-Boza, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Research on the collateral consequences of incarceration shows that over half of previous offenders in the U.S are rearrested within five years of their release from prison. This leads to the question of what obstacles exist for formerly incarcerated individuals post release and in what ways societal institutions are helping or hindering their process of reentry. This research project is based on 10 interviews with formerly incarcerated men about their experiences before, during, and post incarceration. The interviews explore how these men understand their own experiences in efforts to raise awareness on their needs and realities in our communities. The analyses reveal the challenges formerly incarcerated men face socially, economically, and emotionally as they reintegrate into society. Specifically, we find that many of the obstacles the formerly incarcerated men face stem from: the stigma they encounter throughout everyday life, barriers within societal institutions such as the parole system, and emotional trauma related to their experience within the prison industrial complex.



How Music Informs the Identity of a Young Undocumented Immigrant

Danya Dominguez De Anda, and Jayson Beaster-Jones, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

The process of assimilation often pressures young undocumented immigrants to forge new identities. This cultural transformation can cause them to feel as if they have fragmented identities which they must then negotiate to develop their own identities. This autoethnographic study explores how I have used music across my life to craft a narrative identity and how music has served as a conduit for binding my feelings and thoughts to my values. I first establish a definition of "identity" based on a review of literature, then analyze a select set of songs which represent my musical-narrative identity. This analysis will enable me to track the evolution and negotiation of my identity within the context of being a young undocumented immigrant in the United States of America. Finally, I discuss how certain types of music and songs have helped foster my hybrid identity despite the cultural shift experienced as a child and the ongoing cultural customs that render immigrants' humanity as insignificant. The objective of this study is to further examine the relationship between music and identity under these specific political and cultural circumstances, its effects at the individual level, and how this researcher's particular experience might reflect what other young undocumented immigrants go through to preserve or forge their identities.

Accessible Care for the Aging Population in Merced County Senior Facilities

Sandy Dorantes, and Jayson Beaster-Jones, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

As the last wave of the baby boomer generation becomes eligible for entry into some senior facilities it is vital to examine the barriers seniors face in accessing these places. I examine how socioeconomic factors related to the type of healthcare coverage eligibility, the cost of attending the facility, and race affects access to the senior facilities. Using secondary sources, such as the U.S. Census, Merced County files, website information, and an in-depth literature review, I examine senior facility cost, healthcare coverage aid, and barriers seniors face when trying to access these facilities. These findings may continue to assist in our understanding of the limitations diverse racial groups with different healthcare coverage face when trying to find an affordable senior facility that meets their evolving needs. As the aging population continues to grow, outnumbering children by 2035 by an estimated 1.6 million (U.S Census 2017), it is critical for researchers to further investigate the barriers this age group continuously face.

The Fight for Family Farms: Farmworker Success in the Westlands, 1960-1986

Omar Gonzalez, and Mario Sifuentez, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

The Reclamation Act of 1902 brought irrigation to the Central Valley, but required recipients to abide with a land limit of 160-acres per individual and a resident requirement. Unfortunately for the Valley, the Reclamation Act was never truly enforced because wealthy landowners found methods to avoid compliance. The west Fresno area known as the Westlands Water District was notorious for being the region that most avoided compliance with the Reclamation Act. In accordance with initial water deliveries to the Westlands, George Ballis formed National Land for People (NLP) in the 1960s to fight for enforcement of the Reclamation Act. Utilizing newspaper articles, letters between government officials, land sales, maps, water contracts, and financial records I argue that farmworkers were successful in preventing excess landowners from completely avoiding the Reclamation Act until the NLP disbanded in 1986. The notion of replacing agribusiness with family farms in the Central Valley has been abandoned by most politicians due to the influence agribusiness has in society. This research indicates the feasibility of this notion through the organization of farmworkers by highlighting the successful efforts of the past, which informs our understanding of its outcomes in the present or future. Furthermore, this project demonstrates the success organized farmworkers have when combating agribusiness across the nation.

A Historical Analysis on the Chinese in Merced County from 1850-1900

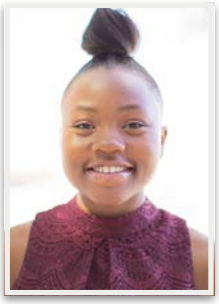
Esther Jin, and David Torres-Rouff, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

How events and individuals are documented in the past influences our understanding of these entities in the present; this is especially true for minority groups. When it comes to Merced County, located in California's Central Valley, historical documentation of nineteenth-century Chinese immigrants is sparse; little is known about how the Chinese formed their own communities - which were pushed to the outskirts of the city of Merced. This research seeks to add more depth to the memory of the Chinese in Merced. In partnership with the Merced County Library, I conducted an analysis using newspaper articles from 1850 to 1900, with a focus on articles and advertisements concerning Chinese immigrants. After extensive research, I discovered little information concerning this minority group. The small pool of evidence that was found supported the stereotypical notion that people of color do not contribute to community formation. As a result, I contend that our understanding of the Chinese in Merced has been impacted negatively. Although the history of Merced's Chinese immigrants has been suppressed, preliminary research seeks to gain an insight on how Chinese residents formed communities and made a life for themselves. Ultimately, this project will add a deeper layer to notions of memory and community within minority groups in the Central Valley.

Cybernetical Systems & Neurophenomenology: Feedback Loops

Marco Laguna, and Jayson Beaster-Jones, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

By recording the dynamics of feedback systems, a researcher can gain insight into the neurological processes involved into the discipline of human embodied cognition through creating an analogical model of the human brain by creating a modular system that utilizes the use of feedback loops. Insights derived from a feedback loop model will allow any researcher to explore areas that reach across an array of multiple disciplines such as cognitive science, psychology and physiology. This is achieved by programming an analogical model by way of modular video and audio synthesis. How this is achieved is a sine wave oscillator is routed through a video signal LFO (low frequency oscillator), into an input and output terminal source simultaneously, thus creating a positive feedback loop. Positive feedback loops, along with other types of loops, allow researchers to collect discreet data associated with the emergent properties associated with feedback systems, and their dynamics. The study of dynamical systems in feedback loops is known as Cybernetics, which has been around since the 1950’s. Along with employing techniques used in assessing subjective phenomena and coding it as an objective occurrence, we are able to create a heuristic to understanding embodied cognition through modeling a neural network using feedback loops through cybernetics and phenomenological models.



Living Black in the Field of Brown

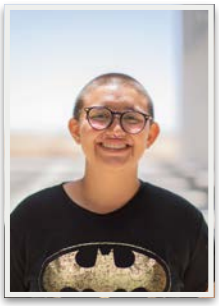
Kaline Leke, and Whitney Pirtle, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Understanding the constant debate for resources and affinity spaces for students within college campuses requires analysis of multiple perspectives from the population themselves. This research project will explore on the retention rates and academic success of Black students at University of California, Merced (UCM). I seek to understand how involvement in black organizations and presence of black spaces help with student success academically & socially. We will study a sample of current Black college students at UC Merced, by conducting online surveys, interviews and focus groups. We will speak to key founding members and members of AFRO (Afrikans For Retention and Outreach) a black living and learning community at UC Merced. The results will give recommendations to use this research and promote institutional change in expansion of affinity spaces.

Living Black in a Field of Brown: A Study on Affinity Spaces

Manuel Leon, Brenna Brock, and Whitney Pirtle, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Historically, universities and colleges across the United States have been spaces for wealthy and white individuals to further their education and increase their economic and social capital. Because of this history, sociological research has found that college campuses can often be perceived as hostile or difficult to navigate by black and African American students. Due to the real and actual threat of racism on campuses to students of color, some students choose to involve themselves in affinity groups to successfully navigate college. Using survey methods and focus group interviews of four to eight people, my team and I seek to explore the black student experience at the University of California, Merced (UC Merced). We will interview black and African American students who have chosen to participate in a program called Afrikan's for Retention and Outreach (AFRO) to understand the impact of AFRO and the types of students who seek these spaces. AFRO is a shared learning and living community meant to increase black and African American Student retention and graduation rates through mentoring and academic workshops. By using focus group interviews I hope to learn about how communal values shape student's self-perceptions because research has shown that having strong communal and family ties positively impacts black and African American student's perceptions of their identities and been shown to increase self-efficacy among students of color. Our research builds upon current literature by studying the experiences of black and African American students at a Hispanic Serving Institution like UC Merced.



Traditional Ashanti Art Against British Colonization

Ashton Melendez, and Muey Saeturn, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

This research study is meant to answer: What were the impacts of British colonization on pre-colonial Ashanti art culture? After close analyzation of pre-colonial Ashanti art versus modern Ashanti art there is a notable change in their art styles (Ashanti being where Ghana is currently). The pieces being analyzed were those of historical significance to the Ashanti society: gold weights, brass cravings, ritual staffs, etc., from the Cantor Arts Center and the Museum of African Diaspora. As well as reading prominently recognized texts of history concerning the Ashanti people and their art, it becomes clearer that European contact does in fact create cultural changes that even show up in Ashanti art styles. It's prevalent that even with religious changes, and colonization, traditional Ashanti art still survives in some areas. Although most have simply explained the art style changing due to the Christian doctrine becoming popular, or that it was due to the government dynamic changing, this change could not have happen due to a singular factor change. The combination, as well as the economic decrease with the fetishization of traditional Ashanti art versus modern West African art are all key parts of this cultural shifting. British colonization is the core reason for all of these factors, a ripple within this pre-colonial society. Ghanian artist continue to create Ashanti art as it was, showing that art culture fights against its oppressor and is able to thrive through large culture changes, due to its historical significance for the Ashanti people.

Bringing Sustainability and Awareness Via a Mobile App

Aldo Montes Sanchez, and Nicola Lercari, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

The John Muir Geotourism App is a digital humanities project that contributes to the discourse on California environmental and local history, such as creation, interpretation, and preservation of human culture. This research approaches the study of John Muir legacy through the lens of Geo-tourism, which as a new type of tourism related to different features on geological and natural sites based on the environment which leads to geo-heritage conservation that goes through a variety of sustainability measures to promote an understanding through education. The primary research method used in this project revolves around analyzing articles regarding geo-tourism or geoparks. The second method was on doing content analysis on a variety of John Muir Apps to be able to enhance the app we are constructing. Furthermore, this work conducts a literature review because most of the results to demonstrate that geo-tourism is bringing more sustainability in the areas where there are geoparks is proved through scholarly articles. My preliminary results show that through geo-tourism local communities become more aware of the history of the San Joaquin Valley and Sierra Nevada Foothills leading to increasing awareness on the significance of historic and environmental preservation in these regions. Overall, this work has explored the role of digital humanities in fostering social and economic justice in the local regions and identified the importance of educating local communities.

Living Black In A Field of Brown

Rochelle Mulondo, and Whitney Pirtle, PhD
School of Social Sciences, Humanities, and Arts, University of California, Merced

Extant research has shown that Black students represent a vulnerable population of students that experience unique struggles which can result in low graduation and retention rates at institutions of higher education compared to other racial groups. Our research team wants to investigate the intricacies of Black student success on the uniquely diverse University of California of Merced (UCM) campus, a Hispanic Serving Institution (HSI), and discover how Black cultural spaces and affinity groups work to aid Black student's success in this context. Black students at UC Merced are graduating at higher rates than Black students at other public universities, and we want to know if this can be attributed to Black affinity spaces. We will conduct a qualitative study that will consist of interviews with key actors in the establishment of AFRO Hall, a Black living and learning community at UCM that was founded in 2014. We will hold two focus groups with Black students (n=18) who belong to this space and students who do not. The results will show how Black cultural spaces effect Black students' academic success at an HSI. This study will reveal whether having Black cultural spaces as a resource in these institutions has a positive impact on Black students' success.

Understanding the 2016 Prison Strikes

Sandy Rodriguez, and Zulema Valdez, PhD
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Historically, the factors that lead to prison strikes in the United States include overcrowding and abuse. However, many Americans are unaware of this history, due to the lack of media attention and the barrier of communication between incarcerated people and the larger society outside. The largest prison strike in history occurred on September 9, 2016, which was the 45th anniversary of the Attica Rebellion. I examined the factors that led to the strike by reading 8 articles, 10 newspaper stories, (Los Angeles Times, CNN) and observing a number of interviews with incarcerated people. Incarcerated people stated they participated in prison strikes as a result of unfair wages, basic amenities and putting an end to solitary confinement. However, many prison staff from a variety of states, denied there being any strikes at all. I found that incarcerated people participated in prison strikes in 2016 ultimately, as a result of putting an end to slavery behind bars. Nevertheless, prison strikes will continue to occur as long as the conditions behind bars continues to stay the same.

Content and Comparative Analysis of Controversial Commercials: Message Sensation Value and Relationship with Viewer's Responses

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Some commercials are formed based on political climates ongoing at the time, as it gathers more attention from viewers. These commercials tend to elicit different viewer responses as viewers gather contradicting messages based on their beliefs. This research uses a comparative and content analysis of two controversial commercials based on German and Mexican immigration from the most watched event in the United States, the Super Bowl. By gathering viewer's YouTube responses shared, background qualities of the commercials and comparing and contrasting the different scenarios and responses from the two commercials, it was gathered that the commercials used many similar characteristics in terms of video, music, and message creation, but used white male versus brown family to articulate their messages to their audience. In the YouTube commentary analysis, it was found that many viewers today have a less aggressive attitude towards European immigration than Latino immigration. The effectiveness of embedding political messages into commercials is seen in these two commercials where it had high commercial views and high viewer responses making it an effective commercial.

Cambodian Refugees Navigating Through a Foreign Education System

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This study discusses the effects of the American Education System on Cambodian Refugees who have escaped the Khmer Rouge. By analyzing the history of the Refugees, one can clarify that the past trauma from the Khmer Rouge and being new to a foreign country puts Cambodian Refugees at an educational disadvantage. This creates a more challenging situation for Cambodian refugees who are trying to navigate the American Education system to achieve a higher education. This study extensively uses information from books and articles that have been written on the experiences of Cambodian Refugees coming to America and books on experiences of Cambodian Refugees surviving the Khmer Rouge. This study is also supported by secondary interviews of Cambodian refugees speaking about their experiences during the Genocide and their new lives in America. The study leads to a conclusion that the violence and shock from surviving the Genocide is carried over when the refugees make a new home in America. This past trauma affects the ability of Cambodian Refugees to adjust to their new lives in America. Despite the hardships, many Cambodian refugees try to adjust to their new lives in America and seek a higher education. Although it may be challenging, the refugees continue to fight their way and navigate the American Education system.

Perceptions of Senior Services in Merced County: A Qualitative Study

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Studies on experiences and perceptions of senior services such as community centers, nursing homes, and assisted living communities tend to be scarce, particularly in rural areas. Seniors are considered vulnerable and are usually diagnosed with at least one or more health complications. Seniors are often less independent and require additional support. There are great alternatives such as nursing homes and assisted living communities, tending to be very expensive. An alternative service for seniors is community centers, but these facilities lack other services that seniors need. Studies have identified several barriers seniors face when receiving or seeking social services and healthcare. This study seeks to fill a gap in the literature of the barriers seniors face, particularly in Merced County, a rural area. Using qualitative interviews, the study examines seniors' attitudes towards nursing homes and assisted living communities. Preliminary findings reveal that there are barriers seniors face when seeking and receiving social services and health care such as affordability, accessibility, comfort, knowledge of where to go, language, and lack of quality of care. In addition, perceptions of nursing homes and assisted living communities vary among seniors depending on knowledge, and family or personal experience. With people living longer and the senior population continuously growing, it is important to understand the struggles seniors face when receiving and seeking adequate services and healthcare they need.

Communication of Hetch Hetchy Debate through Via mobile app

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Communication of Hetch Hetchy Debate through Via mobile app In the mid-eighties, San Francisco experienced the longest drought ever recorded in history. This lead to the process of passing the bill to construct the Hetch Hetchy dam. At the same time, conservationists supported the construction of the dam and preservationists, such as John Muir, fought against preserving Hetch Hetchy wildlife. In 1913, the conservationists won, while the Hetchy Hetchy dam was approved and in 1923 the Dam was Built. Today the Hetch Hetchy reservoir supplies water to the people of San Francisco. This study was drive by the following research question: By what means can geo-tourism mobile apps be suitable to people when discussing the environmental debate of Hetch Hetchy (1908-1913) that brought nation-wide awareness to conserve Yosemite and other national parks? The methods used in this study were to gather data and create a literature review by comparing the impacts of other geo-tourism apps. Another method used was trying to understand using "Map2App" to communicate via mobile apps on the important role debate on Hetch Hetchy environmental debate that helped preserved National Parks. The studies show that geo-tourism apps are viable tools to communicate the history Hetch Hetchy because it allows seeking information about the environment by creating a connection with nature. Lastly adding Hetch Hetchy in Map2App would be a good way to communicate about its history that leads to preserving Yosemite, Sequoia, and the Grand Canyon.

The Complex Issues of Hmong Shamans

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The Hmong are an ethnic group from Southeast Asia who have lived as forced political refugees for the past several hundred years. In the Hmong culture, healing is, and always has been, the main work of the shaman (Pinzon-Perez, 2005). Hmong shamans do not treat physical illness as practiced by western medicine, rather they center their practice around spiritual maladies (Fontaine, 2000). The shamanic practice cannot be learned; shamans are spiritually chosen by their ancestors. Although Hmong shamans are well-respected within the community as healers, the health issues that they have to experience and the changes in their lives are not addressed. Semi-structured in-depth interviews were conducted with 9 Hmong shamans from the Central Valley, Minnesota, and Thailand. Findings revealed that (1) they experienced at least an illness, physically or mentally, before they became a shaman (2) after one becomes shaman, they must cleanse their physical bodies by consuming products that are pure both in preparation and content (3) the healing process exposes shamans to spiritual risks that can potentially end their lives (4) most of their relationships with family and community members become better.

Photos and scholar names listed from left to right. ***Left:*** *2018 SURI Scholars took the practice GRE exam during SURI orientation.* ***Top Right:*** *Vanessa Lam CCBM, John Solo, CCBM, Alexa Capule, CCBM enjoyed the rooftop view from the California Academy of Sciences* ***Bottom Right:*** *Ariell Smith, UC LEADS.*

Merced Nanomaterials Center for Energy and Sensing

MACES

MERCED NANOMATERIALS CENTER FOR ENERGY AND SENSING

MACES Summer Undergraduate Research Fellowship Program: MACES (Merced Nanomaterials Center for Energy and Sensing) was established with support from NASA in the fall of 2015. Our educational mission is to establish a vertically integrated STEM program that will produce a highly skilled and diverse workforce for NASA missions and beyond. One of the key components of the program is a 9-week long summer undergraduate research program that recruits students from local community colleges and nearby CSU campuses. Students will work side by side with UC Merced graduate students and faculty. Through structured mentoring and intensive hands-on training, students in the program will gain the experimental skills that allow them to effectively and safely work in a laboratory setting. This will be complemented by a weekly seminar series that introduces students to different research topics conducted in MACES and at NASA. Upon completion, students will be able to demonstrate basic knowledge of their research area and to summarize their own research.

Optimization of functionalized gold nanoparticle purification

Angel Avalos, Yehan Shang, and Tao Ye, PhD
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Surface Enhanced Raman Spectroscopy (SERS) often uses nanostructured substrates to achieve ultrasensitive sensing of analytes. To form these substrates, we bind DNA functionalized gold nanoparticles (AuNPs) to a hollow 3-D DNA Origami template. One challenge is that functionalized AuNPs need to be purified to remove excess free DNA prior to the assembly of our trimer structure because free DNA interrupts base-pairing interactions needed for substrate assembly. Current protocol of functionalized AuNP purification has low yield and is time-consuming, especially for large AuNP. Here, we purified functionalized AuNPs from solution by using a size exclusion Amicon column. Functionalized AuNP was transferred to the passivated Amicon column and spun at 10000x g for 5 min. The retention was diluted to 500µL with TE buffer. This process was repeated for a total of three cycles. Removal of excess DNA was confirmed through gel electrophoresis. Purification yield was calculated at a three-fold improvement. Our optimal purification protocol can be finished within a few hours and will facilitate the assembly of our SERS substrates.

Surface chemistry of activated carbon

Mary Barker, Ali Hassanzadeh, Neda Seyedhassantehrani, and James Palko, PhD
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Electrically regenerated carbon adsorbents can be an effective tool for removal of a variety of contaminants from water. The porous nature of activated carbon yields a large surface area for chemical reactions to take place. One of the barriers to building a cell to treat water using this approach is understanding the surface chemistry of an activated carbon electrode. To quantify the number of carboxyl groups on the activated carbon, a Boehm titration was performed. This method involves selective neutralization with a reaction base (sodium bicarbonate) followed by an addition of excess acid and back titration to determine the initial concentration of acidic groups. Activated carbon in powdered and cloth form were studied both as received and following nitric acid oxidation. We report the effects of starting material and oxidation on surface carboxyl concentration, and we discuss potential for additional surface functionalization chemistries.

NITINOL 60: A Promising Alternative for Spacecraft Bearing Application

Josue Banuelos, Azhar Vellore, MS, and Ashlie Martini, PhD
School of Natural Sciences, University of California, Merced

Material composition for bearing application is of concern to the aerospace industry due to the strict requirements that spacecraft have to meet. High corrosion-resistance, low friction-wear, and less weight are just a few of the requirements that have to be taken into account when producing bearings and hardware for spacecraft. The purpose of this research is to characterize 60NiTi (NITINOL 60) and 52100 steel to know which is better suited for the manufacture of spacecraft bearings. The two methods employed in the mechanical characterization of these two specimens were the Rockwell Hardness Test and Scratch Resistance Test. A multi-function tribometer from Rtec Instruments was used to perform the scratch and indentation tests. The scratch hardness number and the average indentation hardness number were compared to determine their hardness characteristics. This data shows that 60NiTi is better suited for space bearings than 52100 alloy steel because its higher in scratch hardness and indentation hardness. With the advantage that 60NiTi has of being corrosion resistant over the 52100 steel, space craft now can be stored for longer periods of time with no problems of bearing corrosion decay.

3D Hierarchical Carbon Structures with Abundant Redox Sites for Energy Storage

Jacqueline Bustamante, and Jennifer Lu, PhD
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3D hierarchically porous carbon materials have been regarded as promising electrode materials for application in energy storage and conversion devices, such as electrochemical capacitors and fuel cells. In addition to providing an improved surface area and accessibility to active sites, the hierarchically porous structure provides pathways for facile mass diffusion of electrolyte for faster reaction kinetics. Among many attributes, carbon is plentiful in nature, possesses great chemical resistance, and is known for its excellent electrical conductivity. This makes it an ideal material for the generation of a conductive scaffold with good mechanical integrity that could be conformally grafted with an electroactive polymer. Chemical vapor deposition was employed to etch the carbon cloth with potassium hydroxide in efforts to increase overall surface area. Varying concentrations of the etchant were investigated to identify an optimal amount that would maximize charge adhesion. Further, a process to purify a nitrogen-rich polymer, 1,5-diaminonaphthalene, and then electropolymerize the compound onto the electrode platform to generate a conformal coating, was established. The conductive scaffold with densely packed and abundant redox centers is expected to increase energy storage density. Energy storage capability was elucidated electrochemically by cyclic voltammetry and surface morphology was revealed through scanning electron microscopy. The interim work has helped lay the foundation for future research that will further explore the usage of the platform for both energy storage and conversion as well as water purification.

The Synthesis of Carboxyl-Functionalized 5,6,11,12-Tetrahydrodibenzo[*a*,e] cyclooctenes: Building Blocks for Copolymers Exhibiting Negative Thermal Expansion

Jesse R. Cantrell, Thanh Lien, and Benjamin J. Stokes, PhD
School of Natural Sciences, University of California, Merced

Solid substances that exhibit negative thermal expansion (NTE) are rare. Such substances expand upon cooling and contract upon heating. Hydrocarbon-based materials that exhibit NTE are rarer than metal-based ones and are attractive because they could be incorporated into organic polymers. 5,6,11,12-Tetrahydrodibenzo[*a*,*e*]cyclooctadiene (DBCOD)-based materials have recently received attention because temperature-dependent interconversion between eight-membered-ring conformations can lead to NTE polymers. However, functionalized eight-membered carbocycles are generally difficult to synthesize. We therefore set out to develop scalable synthesis of 2,9-dicarboxyl-functionalized DBCOD to serve as precursors to copolymer libraries. Herein we describe and compare our synthetic approaches and provide variable temperature nuclear magnetic resonance (VT-NMR) and differential scanning calorimetry (DSC) analyses of the target to profile its conformational change behavior.

Spin coherence lifetime measurement in perovskite quantum dots using Hanle effect

Efrain Covarrubias, Som Sarang, and Sayantani Ghosh, PhD
School of Natural Sciences, University of California, Merced

Spintronics and quantum computation employ electron spins as qubits for information storage and is an active field of research in condensed matter physics. A measure of the effectiveness of any platform using electron spins is the coherence lifetime, which measures how long an electron can retain its spin state. A long spin coherence lifetime of the order of 1-100 ns is expected of quantum dots as was observed in InAs and CdSe samples. We employ the Hanle effect to measure the scaled transverse spin lifetime gT of spin polarized photo generated carriers in hybrid perovskite quantum dots. Perovskite quantum dots have made their foray into opto-electronics research due to their tunability in the visible spectrum, stability, and facile synthesis methods. In the Hanle effect, we measure the degree of circular polarization of emitted photons from charge carrier recombination, which in turn is used to determine spin projections along the direction of observation. In our research we will be testing different perovskite QDs to estimate their spin coherence lifetime at low temperatures aimed towards the development of new spintronic devices.

Wear Characterization of Nitinol(60NiTi)

Adam Delong, Azhar Vellore, MS, and Ashlie Martini, PhD
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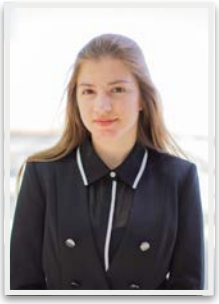
Nitinol (60NiTi) has shown great promise as a bearing material by having a combination of characteristics that is shared by no other known bearing material i.e. corrosion resistance, conductivity, high hardness, high wear resistance and being non-magnetic. Bearings are mechanical elements that restrict the relative movement of an object in a desired direction while reducing friction. To compare Nitinol to conventional a bearing material, 52100 steel, a tribometer was used to measure friction between two materials while they slide against each other along a set path under a constant load. During testing, Nitinol and 52100 balls slide against a 52100 steel surface. Different test durations and set loads are applied to achieve a wear volume – the amount of material lost from the material during the test - showing how much wear both materials can resist. Wear resistance is important because, in settings such as space, mechanical parts are incredibly difficult to replace, if replaceable at all. In this study, we report the tribological performance of Nitinol compared to 52100 steel.



Synthesis of Single-Stranded DNA Scaffolds for DNA Origami Tile Assembly

Gloria-Alexandra V. Gueorguieva, Huan H. N. Cao, PhD, and Tao Ye, PhD
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DNA origami nanotechnology has become one of the key components for engineering self-assembling materials. The technique utilizes a long single-stranded DNA (ssDNA) scaffold to recruit short oligonucleotides for specific DNA hybridization that staples the scaffolds into predesigned nanoscale structures. These nanostructures have widespread applications including photonics, biosensing, enzymatic catalysis, single-molecule fluorescence, and drug delivery, requiring the DNA nanostructures to be different sizes and shapes. However, the sizes of DNA origami structures are currently limited to the length of the single-stranded viral genome. Thus, strategies to create ssDNA scaffolds of different lengths will provide venues to the preparation of nanostructures at any desirable sizes. Here, we used polymerase chain reaction (PCR)-based techniques to generate double-stranded DNA (dsDNA) scaffolds. Lambda exonuclease enzymes were used to digest the complementary DNA strands, yielding the single-stranded scaffolds that were folded into DNA origami tiles. Gel electrophoresis showed that the enzyme reactions produced an ~80% yield of ssDNA scaffolds from the dsDNA scaffolds. The folded tiles were imaged with atomic force microscopy and gave a yield of ~85%. Thus, our approach was successful in allowing us to synthesize different lengths of ssDNA scaffolds and fold them into desired sized DNA origami tiles, which may now be used for the mass production of larger, more complex DNA structures.

Investigation of the Effect of Oxidative Processes on Poly-(1,8 diaminonaphthalene)

Yaneth Hernandez, Wenxin Fu, PhD, and Jennifer Lu, PhD
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Owing to its fused aromatic and conjugated structure, poly-(1,8-diaminonaphthalene) has the potential to form nitrogen-doped carbon at high char yield, rendering it a promising compound for both energy storage and conversion. Both the selected oxidant and degree of oxidation are expected to impact chemical structure as well as the properties of the char yield, subsequently affecting performance such as in electrocatalysis for the oxygen reduction reaction. The effects of varying molar ratios of the oxidant ammonium persulfate to 1,8-diaminonaphthalene on polymer structure were investigated and characterized by Fourier-transform infrared spectroscopy and thermogravimetric analysis. In the short-term work, the objective was to identify an optimized chemical structure and corresponding process for maximizing oxygen reduction reaction performance. The efforts have helped lay the foundation for future endeavors of exploiting the conductive polymer for energy storage and conversion.

Parallelizing Code that Stimulates a Hydrogenated Amorphous Silicon Structure

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Hydrogenated amorphous silicon (a-Si:H) is a material found in solar cell devices that require only a small amount of power. Through computational stimulations, we can emulate the structure of a-Si:H to replicate and observe its photovoltaic properties. The CHASSM (Computational Hydrogenated Amorphpous Semiconductor Structure Maker) C++ code is a classical potential Monte Carlo ode used to stimulate the structure of a-Si:H. Using OpenMP, we have altered the CHASSM code to run in parallel any time it calculates the potential energy of the a-SI:H structure. The time decrease observed after parallelization can help to generate a larger and more accurate a-Si:H structure in less time. Multi-threaded parallel computing can be applied to many programming problems, as displayed in this application, and is becoming more prevalent in the high-performance computing field.

Scholars at the 2018 Summer Undergraduate Research Institute Welcome Dinner hosted at UC Merced during their Orientation.
Scholar names listed from left to right. ***Top Left:*** *Jocelyn Acosta, SURF, Danya Dominguez De Anda, SURF and David Olson, SURF* ***Bottom Left:*** *Adam Delong, MACES and Cassandra Maldonado, CCBM* ***Right:*** *Yasmin Ochoa, ASPIRES and Jesse Sanchez, ASPIRES*

Accelerated STEM Pathways through Internships, Research, Engagement, and Support

ASPIRES
Accelerated STEM Pathways through Internships, Research, Engagement, and Support

The "Accelerated STEM Pathways through Internships, Research, Engagement, and Support" (ASPIRES) program is a collaboration between Canada College's Engineering Department, San Francisco State University of Engineering, and UC Merced. The project is supported by a grant from the US Department of Education through the Minority Science and Engineering Improvement Program (MSEIP), Grant No. P120A150014

1. The overarching goals of the ASPIRES program are: to increase the retention and success in STEM courses among community college students from traditionally underrepresented minority (URM) groups in STEM;
2. To increase awareness of and interest in STEM careers among k-12 and community college URM students; and;
3. To increase the number of URM students receiving AS degrees and transferring to four-year institutions to pursue STEM degrees.

Robust Flight Classifications using Gazebo

Oskar Granados, Jose Alcala, and YangQuan Chen PhD
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The safety surrounding the proper execution of small-Unmanned Aerial Systems (sUAS) has become the subject of concern. Consequence-aware-systems, which overrides the pilot control in the event of potentially dangerous flight conditions, have been implemented as a safety precaution. However, one aspect that needs improvement is the development of a more robust sUAS that integrates a graphical user interface (GUI) and statistical analysis to determine the accuracy of flight performance. The proposed solution to improve the validity of a flight is by analyzing, through a flight simulator, the difference between the estimated and actual flight patterns at varying time intervals of UAV flight logs, where a significant difference yields an unsatisfactory flight. Statistical analysis will examine 6 Degrees of Freedom (DoF) that embody the UAV, error and input/output signals generated by the sUAS warning system, commands from the user, and signal loss. By connecting the ground control, MAVROS, and Gazebo, the user can examine the quality of the flight by providing a start and stop button to the flight simulator, a visual of the UAV, and summary of the source(s) of error.

Flight Patterns Classification and Error Estimation for Small Unmanned Aerial Systems

Yasmin Ochoa, Jose Alcala, and Yang Quang Chem, PhD
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In the past few years, Small Unmanned Aerial Systems (UAS) have become the target for consumer interests like delivery of packages, military, and industry uses. In order to make UAS available for more widespread commercial uses, the safety of these systems must be improved by adding another security platform. In order to contribute to this goal, this project gathered information about patterns in successful or unsuccessful drone flights. This project conducted drone flight simulations using an AirSim simulator, and classified each flight as good, meaning the flight followed the prescribed path and took off and landed safely, or bad, meaning the pilot lost control of the drone. Once the flights have been classified, analysis of flight data determined the factors that make a flight good or bad according to these definitions. The AirSim simulator provided data about the frequency of the following errors: pilot-command, alerts and alarms, landing error, and takeoff error. Analysis of the frequency of these errors revealed that five key factors contribute to a drone flight's success: human error, environmental conditions, the rate of change in altitude, the yaw angle, and the difficulty of the prescribed path. These findings can be used to build a new safety platform, written in python, that incorporates MAVROS and machine learning, in order to improve UAS safety, and enable more widespread commercial use.

Experimental Approach to 2-Dimensional Horizontal Flow Phenomena in Thin Films

Jesse Sanchez, Yanbao Ma, PhD, and Krishna Shah, PhD
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Soap film tunnels provide an ideal candidate for experimental analysis regarding fluid-structure interaction and two-dimensional flow phenomena. Soap films are formed due to the aggregation of surfactant molecules possessing amphipathic properties. A sheet of flowing water on the micron scale occurs within the surface layers of the film providing opportunity for experimental analysis in a realm confined to theory or simulation. This experimental approach utilizes horizontal soap film tunnels as a tool to investigate 2-dimensional flow by propelling soap films using electro-motion in the wiring system to create uniform flow within the film. We utilize monofilament fishing line for our guide wires and a braided polymer line for the injection and exit channels. The guide wires are threaded through the center of rings which are anchored to the supporting framework. The injection and exit lines are connected to the suspended rings to create a closed network to establish the film. Using various measurement techniques including Schlieren Imaging and Laser Doppler Velocimetry we can analyze density variations throughout the film and corresponding velocity fields to better understand turbulent behavior within 2-dimensional flow. This area of study possesses a wide range of applications on both the micro and macro scale as oceanic and atmospheric behavior can be analyzed as a 2-dimensional fluid as well as our approach to creating efficient microfluidic systems associated with manufacturing and bioengineering.

Center for Cellular and Biomolecular Machines

The Center for Cellular and Biomolecular Machines (CCBM) is a National Science Foundation (NSF) Center of Research Excellence in Science and Technology (CREST) at the University of California, Merced. The NSF-CREST CCBM uses an interdisciplinary approach cutting across scientific and engineering methodologies to: 1) Pursue a fundamental understanding of the structure, dynamics and functioning of multi-scale biomolecular and cellular assemblies with the goal of enabling control of function in vivo; 2) Use these fundamental principles to design and develop novel bio-inspired functioning machines ranging from designer cells and tissue to diagnostic and therapeutic devices, and 3) Host an integrated, interdisciplinary training program for graduate students that uniquely emphasizes both physical and biological components and provides research and training experiences for undergraduate and high school students that will enhance the recruitment of those traditionally underrepresented in STEM research.

The biochemical basis of circadian clock protein KaiA's confirmation shift

Daniel Boesch, Archana Chavan, PhD, and Xuejun Yao, PhD
School of Natural Sciences, University of California, Merced

Biological rhythms are ubiquitous among lifeforms, tracking the days, years, seasons, lunar cycles, and even tides. Though the importance of circadian rhythms to the survival of the organism is undisputed, its mechanism is not entirely understood. A popular experimental subject is the Kai circadian oscillator system within the cyanobacterial model organism *Synechococcus elongatus*. The Kai oscillator produces a surprisingly complex dynamic output with relatively few components. One potential contributor to this complexity is the alpha five helix of KaiA, which is suspected to influence KaiA conformation changes according to temperature. These different conformations interact distinctly with the other components in the oscillator, thereby altering output signals. To study the role of the alpha 5 helix in these protein conformations, the truncated domain was produced through PCR then transformed into bacteria, alongside the mutant L156A; the interactions of the wild-type and mutant-type proteins with KaiA N-terminal and C-terminal domains were then compared using fluorescence microscopy. The residue Leucine156 proved to be vital to the KaiA's conformation shift, as the mutant disrupted the balance of interaction affinities preserved by truncated alpha 5 helix. With this development, the mechanisms of KaiA are better understood, leading to more directed future experimentation.

Elasticity and Rheology of Mucin Gels

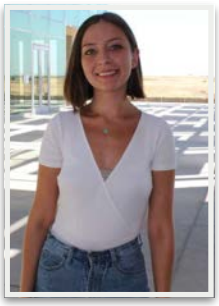
Alexa Capule, Donglei Yang, and Arvind Gopinath, PhD
School of Natural Sciences, University of California, Merced

Candida albicans (*C. albicans*) is a commensal fungus that asymptomatically colonizes areas of the human body such as the GI and GU tracts and can cause infections in immunocompromised individuals, including AIDS patients, patients undergoing anticancer therapies, and transplantation patients receiving immunosuppression therapy. To date, most studies of *C. albicans* have been carried out in planktonic cultures; however, the medical impact of *C. albicans* depends on its ability to form surface-associated communities called biofilms, especially on surfaces lined with mucus, a porous, biopolymer mesh comprising of glycoproteins, water, lipids, and other extracellular biopolymers. These constituents together confer intriguing solid-like and liquid-like properties – that is, the mucus behaves as a complex, viscoelastic material. This research focuses on studying the rheological properties of mucus at physiologically relevant conditions and in states far from normalcy. Mucin is made at concentrations ranging from healthy to diseased, 0.5%-10%, and a shear rheometer (Malvern, Ultra+) is used to characterize properties such as elastic (storage) modulus and viscous (loss) modulus by applying steady shear, oscillatory shear, and creep compliance tests. We find that as concentration increases, the mucin suspension acts more like a solid than a liquid, with increasing gel like behavior. Our results provide a foundation to analyze how biofilms of *C. albicans* alter the fungus free mucin network.

Expression, Purification and Characterization of Recombinant Protein Mutant; Calnuc for Ca^{+2} ion Sensing

Joaquin Cardozo[1,2], Abhigyan Sengupta[2], Nivin Mothi[2], Mourad Sadqi[2], and Victor Muñoz, PhD[2]
Oberlin College, Ohio[1]; School of Engineering, University of California, Merced[2]

Calcium is involved in many signal cascades regulating a wide variety of processes in eukaryotes, including neurotransmitter release and muscle contraction. The goal of the project is to develop a molecular scale biosensor with ultra-fast Ca^{+2} ion concentration readouts. To achieve this goal many mutants must be designed and tested. I have tested the expression, purification and spectroscopically characterized one of these mutants, Sumo-Calnuc. This process involves designing a plasmid with a gene that encodes for the current mutant being tested. The protein was expressed by using *E. coli* host cells and recombinant DNA techniques. Our previous experience showed that Calnuc does not express in cells due to its low structural stability. We have used SUMO tagging to enhance functional protein production, solubility and stability in cells. After expression, we lysed the cells to extract SUMO-Calnuc and used variety of high-pressure liquid chromatography (HPLC) techniques to purify the protein. After initial purification, a protease was used to cleave SUMO from recombinant fusion proteins, and the Calnuc was further purified using different HPLC techniques. Gel electrophoresis (SDS-PAGE) and mass spectrometry analysis were used to confirm purity of the desired protein. After reverse phase HPLC the protein samples were snap frozen and lyophilized for long-term storage at -21C. Fluorescence and circular dichroism were used to characterize properties of Calnuc.



Genetically Engineered Inflammasome Adapter ASC

Andrea Gould, and Eva de Alba, PhD
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The protein ASC functions as a molecular glue by mediating the assembly of the inflammasome, a multiprotein platform that triggers the body's inflammatory response. ASC has a bipartite architecture consisting of two Death Domains (PYD and CARD) tethered by a linker. ASC domains intervene in protein-protein interactions within the inflammasome components and also promote self-association. Two natural isoforms of ASC that only differ in the linker length (ASC with a 23 amino acid linker and ASCb with a 3 amino acid linker) show different self-assembly behavior in the cellular environment. Thus, the linker length has potential influence in ASC self-association properties and inflammasome assembly. To test this hypothesis we will compare our recent studies on ASC oligomerization with those of ASCb and an artificial protein that we have engineered with a linker 3 times as long as ASC linker (69 amino acids; ASC_3X). Our transmission electron microscopy and NMR data indicate that ASC forms micrometer-long filaments and filament bundles composed of dimers that pile up by binding through homotypic PYD-PYD and CARD-CARD interactions. The information gained on the dependence of ASC Death Domain interactions with the increase in linker length will help in the design of new constructs to manipulate filament formation with potential applications in biomaterial engineering.

Engineering Protein as a Fluorescent-based pH Biosensor

Avneel Hundal, Abhigyan Sengupta, PhD, Mourad Sadqi, PhD,
and Victor Muñoz, PhD
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Intracellular pH is the driving force for many cellular functions including energy synthesis, molecular transport, gene regulation and expression. Quantification of these changes in live cells will help to develop insight into the role of pH in cellular activities. In Muñoz lab at UC Merced, we aim to create a recombinant protein based fluorescent biosensor that is less toxic to the cells and easily permeates the cell membrane. The process was initiated by engineering a naturallyoccurring protein called SUMO-gpW with tetra-cysteine motif (-CCPGCC-), which is able to bind a small fluorescent ligand known as FlAsh-(EDT)2. At first, the protein was mass produced using E. coli host cells, lysed, then purified using HisTag and Reverse-Phase HPLC. Next, a binding reaction was used to attach the FlAsh compound to the gpW. The fluorescence intensity of the FLAsh dye being sensitive to the binding, is utilized to confirm the binding interaction between FLAsh and protein. Finally, different pH buffers are used to characterize the fluorescent intensities, and a pH dependent change of fluorescent intensify is successfully observed.

Using photoluminescence and quenching to investigate energy transfer mechanism of Gold Nanoclusters

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Gold nanoclusters, designated Au_{25}, are highly stable crystal structures that consist of 25 gold atoms. Such few atoms significantly alter the properties of these nanoclusters, which behave neither like bulk material nor like traditional gold nanoparticles. Given the novelty of these clusters, the exact nature of energy transfer (ET) between these nanoclusters and other fluorophores is not understood. The usual mechanism, Förster Resonance Energy Transfer (FRET) used to describe the fluorescent energy transfer between a donor and acceptor molecule, has an efficiency described as $E = 1/1 + (r/R0)^6$where r is the distance between the donor and the acceptor and R_o is the separation where the efficiency decreases by 90%. The purpose of this research is to verify if FRET is the governing mechanism in play, or if the distance dependence is different. Energy transfer will be observed between Au_{25} (quenching element) and Rhodamine B 640 (R640). Excited at 530 nm, the emission of R640 is collected at around 610 nm. By utilizing a spectrometer and photodiode, the photoluminescence and lifetime data are measured for R640, and R640 mixed with Au_{25}. Data shows that the quenching effect is observed for R640 mixed with Au_{25} because as lifetime is changing, quenching is present. Verifying FRET efficiency is significant because it has future applications in *in vivo* imaging and biosensing.

Effect of Sedimentation Time on Vesicle Detection Grown on Filter Paper

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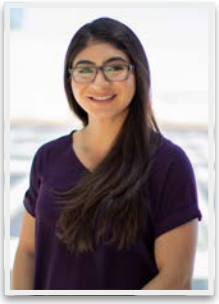
GUVs (Giant Unilamellar Vesicles) are used for constructing synthetic cells, drug delivery vessels, and base structures for the study of cell membranes. Because functional applications of GUVs require a large supply, scalability of the growth process is important. Production of GUVs through PAPYRUS (Paper Abetted liPid hYdration in aqUeous Solutions) is scalable and less complex than previous methods. We evaluate the PAPYRUS method by analyzing extracted vesicle populations that are density mismatched with the surrounding solution, and thereby sediment to the bottom of a viewing chamber. It is unknown what sedimentation time is optimal to capture images that reflect a complete data set of the extracted vesicles. We used confocal microscopy and a custom MATLAB routine to study the effect of sedimentation time on the population and size distribution of detected GUVs. Larger vesicles have a higher sedimentation rate, and thus we expect that insufficient sedimentation time might bias the measured size distributions. Knowledge of how the size and quantity of GUVs varies with sedimentation time will help further characterize the PAPYRUS method.



Co-development of Endothelial and Smooth Muscle Cells on Different Matrix Elasticities

Cassandra J. Maldonado[1], Jose E. Zamora[2], and Kara E. McCloskey, PhD[2]
School of Natural Sciences, University of California, Merced[1];
School of Engineering, University of California, Merced[2]

Advances in stem cell (SC) technologies have revolutionized the field of regenerative medicine. However, achieving fully functional and perfusable in-vitro organs will require a better understanding how vasculature develops. In 2006 Engler et. al showed that SCs could be induced down a particular cell fate based on the stiffness of their culture matrix. Using this idea, we hope to understand the role of matrix elasticity in the development of endothelial cells (ECs) and smooth muscle cells (SMCs). We are analyzing how mouse embryonic stem cells (mESC) respond to various matrix elasticities by culturing Flk-1+ vascular progenitor cells (VPC) on polyacrylamide hydrogels as well as a plastic control. We induced mESC into both ECs and SMCs via a two-step treatment with our chemically defined mediums. First, the mESC were induced into Flk-1+ VPC. Then the VPCs were sorted (Flk-1+) and plated onto our soft and stiff hydrogels, where they differentiated into co-cultures of ECs and SMCs. We characterized our co-cultures by analyzing the expression of EC markers (VE-Cadherin, CD31) and SMC marker (CNN1). We quantified our EC and SMC ratios via immunofluorescence staining and flow cytometry. Our studies showed that the softer matrix directs more EC while the stiffer matrix directs more SMC. This will lay down the foundation for developing a computational spatial vasculature model under specific elastic constrains such as those found in 3D cultures.

Tagging Proteins of Interest with Split Fluorescent Proteins in Zebrafish

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Genetically-encoded fluorescent protein (FP) fusions are an important tool for studying proteins of interest. Many FPs fold into a β-barrel which consists of 11 β-strands. Split FPs consist of two separate parts: β-strands 1-10 and β-strand 11. Separately, the two individual parts will not fluoresce, but together, they form a complete β-barrel and will reconstitute a functional fluorescent protein. This bimolecular approach allows for greater flexibility in terms of temporal and spatial control of fluorescence in tissues and proteins of interest. Here, we test the feasibility of using split-FPs to tag proteins of interest in zebrafish embryos. First, we compared two different split-FPs, split- mNG (monomeric Neon Green) and split-GFP. We found that split-mNG was brighter than split- GFP in zebrafish embryos. Therefore, subsequent experiments focused on the split-mNG system. We next show that fluorescence can be restricted to a specific tissue when the mNG1-10 component was expressed under control of a tissue specific promoter even while mNG11 component was ubiquitously provided. Finally, we show that mNG11 can also be knocked-in (KI) to endogenous genes with CRISPR/Cas9. Since mNG11 is only 48 nucleotides long (16 a.a), this is an efficient way to endogenously tag proteins of interest. With this system, proteins of interest can not only be tagged, but their fluorescence can be restricted to specific tissues and/or specific timepoints.

Computational tool bridging image network extraction and *in silico* kinesin-1 mediated transport on real microtubule networks

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Active intracellular transport occurring critically within living cells is regulated by molecular motors that propel cargo along a dense microtubule network. Analyzing the entire system of networks is imperative for determining the fundamental nature of microtubule-based cargo transport and can lead to understanding how multi-motor cargos work in conjunction to achieve efficient long-distance transport. This process can be reconstructed computationally by extracting known fiber networks through an algorithm that performs image analysis and returns the geometric properties of the network to guide simulated cargo transportation. This study is essential for developing a model that focuses on the relationship between diffusive Kinesin-1 motors and microtubule-based transport. By creating a user-friendly MATLAB graphical user interface that links these two together, the data pipeline streamlines that transfer of the extracted topology of these networks to the simulated motor-based transport of the cargo. The streamlined interface eliminates the need for manual data entry and provides an intuitive application for creating computer-generated transported cargo data driven by Kinesin-1 motors. Researchers can utilize this software toolkit to iteratively test computational models on real networks, which has the potential to assist in the design of better transport experiments.

Using Computer Algorithms to Reduce Time for Image Analysis

Anmoljot Thandi, and Joel A. Spencer, PhD
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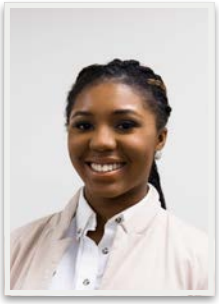
With current tissue clearing techniques, whole organ imaging with sub-cellular resolution is routinely possible. Evaluating what these large image sets mean can be a long and tedious process, however. Currently, we image thymus tissue labeled with molecular reporters and then process the images for 3D reconstruction and locate the features of interest (e.g., cells) using complex and time-consuming image processing methods. If we could acquire images while simultaneously doing 3D reconstruction and image analysis, it would greatly decrease the time it takes for us to conduct and interpret our imaging experiments. GPU-based computer vision techniques may aid in reducing the time for reconstruction and analysis. In this project, we will create a training set of data from our whole thymus imaging data sets, to be used for the computer vision algorithms. We will manually locate hundreds to thousands of cells of interest and record the coordinates using a region of interest function within ImageJ software. Then we will use a custom Matlab script to pull out the necessary 3D coordinates for each cell. Finally, we plan to feed this training set into a computer vision algorithm and attempt to develop a fast image analysis workflow that can be used for whole thymus imaging. If successful, we will implement the GPU-based computer vision technique into our current imaging workflow to minimize the time from image acquisition to image analysis.



Investigating the interaction of *Escherichia Coli* with solid obstacles in polymeric solutions

Ladaisha Thompson, and Pooja Chopra, and Bin Liu, PhD
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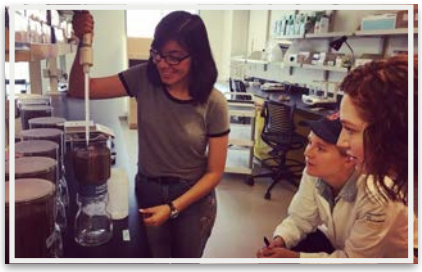
Flagellar propulsion is a mechanism utilized by many types of bacteria in order to move through complex fluid media, including polymeric solutions that are combined with solid structures. *Escherichia Coli* (*E. coli*) that run and tumble have been observed to run quicker and tumble less frequently in polymeric solutions as compared with the pure water case. Here, we mimic a more natural habitat using a micropillar array along with polymeric solutions. In this way, we are able to observe how the bacteria move and avoid obstacles in fluids of varying viscoelasticity. More specifically, we investigate how *E. coli* transport in such a complex environment under a 3D tracking microscope, and compare the results with the soley viscoelastic case. This observation leads to rigorous understanding of how the motility of bacteria can be affected by a natural environment for better controlling the spread of bacteria in the future.



Photos and scholar names listed from left to right. ***Left:*** *Gurbinder Singh, SURF* ***Top Right:*** *Olivia Alvarez, UROC-H* ***Bottom Right:*** *Fatima Gamino, SURF*

American Physiological Society

The American Physiological Society (APS) is a nonprofit devoted to fostering education, scientific research, and dissemination of information in the physiological sciences. The mission statement is to advance scientific discovery, understand life, and improve health. Their vision for the society is to create a global multidisciplinary community of scientists solving the major problems affecting life and health.

Heart Healthy: Measuring Parkin Expression after Caloric Restriction in Insulin-Resistant Obese *Rattus norvegicus*

Chelsy Cummings, and Rudy Ortiz, PhD,
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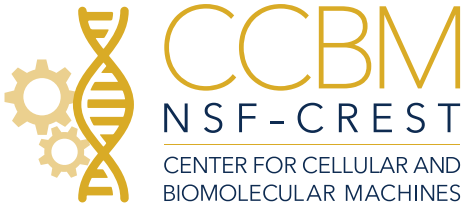
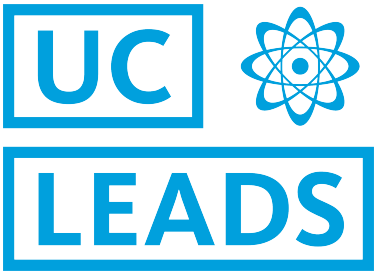
The human body constantly struggles to maintain a homeostatic state. When the standards of the body are irregular, there can be lasting effects. Mitochondria provide energy to various organs in the body, making the task of removing defective mitochondria to make room for healthy mitochondria highly important. The Parkin gene is an essential component of the Parkin/PINK1 pathway. Parkin assists in mitophagy, the process in which malfunctioning mitochondria is tagged for degradation. An impairment in the Parkin gene results in an unusual amount of functional and nonfunctional mitochondria, potentially leading to many diseases such as type two diabetes mellitus and cardiovascular disease. To carry out this experiment, I extracted tissue from the hearts of 4 groups of rats: Long Evans Tokushima Otsuka (LETO), Otsuka Long-Evans Tokushima Fatty (OLETF), LETO with caloric restriction, and OLETF with caloric restriction. Through the utilization of western blotting, I probed for Parkin in the hearts of each group. Recent studies lead me to expect Parkin expression to be in abundance in LETO insulin sensitive rats rather than the insulin resistant OLETF rats. I also anticipate the caloric restriction to restore Parkin gene presence in the OLETF rats. This experiment was conducted with the hopes of understanding one of the many causes of cardiovascular diseases in model organisms. Perhaps with the information gathered, we can present an alternative to correcting distinct heart diseases.

Sponsored by the Undergraduate Research Opportunity Center

A special thank you to all our partners that contributed to making the 2018 UROC Summer Undergraduate Research Institute possible:





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