UCMERCED

UROC Undergraduate Research Opportunities Center UC MERCED

SUMMER UNDERGRADUATE RESEARCH SYMPOSIUM

FOSTERING ACCESS & SUPPORT

SUMMER 23

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WELCOME MESSAGE
FROM THE UROC TEAM

UROC Staff: Jorge Arroyo, Valerie Anderson, Aliyah Mcguire, Diana Hernandez Garcia, Madeline Bird
UROC SURI Grad Mentors: Kesia Garibay, Edgar Perez Lopez, Thomas Paniagua, Bianca Hinojosa, Selina Espinoza, Jose Morales, Jose Milan Higuera, Mikey Bernal, Arabi Seshappan, Jaskanwaljeet Kaur
Not Pictured: Violet Barton

Welcome to the 17th annual Summer Undergraduate Research Symposium.

This symposium marks the end of SURI, The Summer Undergraduate Research Institute. It is a chance for our students to showcase all they have accomplished and how they have grown. We are so proud of them!

Thank you for supporting our students and team by attending the symposium. We hope you enjoy learning about all the questions that are being asked and answered by our SURI Scholars!

Best,
The Undergraduate Research Opportunities Center staff and Grad Mentors

SYMPOSIUM SCHEDULE

9:00am
Breakfast

9:30am
Symposium Welcome

10:00am
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11:00am
Presentations: Session B

12:00pm
Lunch

12:00pm
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1:00pm
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Presentations: Session E

3:00pm
Closing Notes

Poster Presentations

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#1 Alexis Galaz
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#3 Amy White
#4 Andrew Valdivias
#5 Brooke Olsson
#6 Calvin Hoang
#7 Cindy Torres Camacho
#8 Conor Olive
#9 Daisy R Zapet Bamac
#10 Dylan Jong
#11 Elia Lopez
#12 EunSang Park
#13 Hyun-Jeong Lee
#14 Ilse Flores
#15 Isabel Robles
#16 Israel Castillo
#17 Kanghong Li
#18 Kate Larios
#19 Lina B-Hernandez
#20 Luis Fujarte
#21 Maria Isabel Ruiz
#22 Paul Stratton

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#1 Agustin Molina
#2 Aphril Del Socorro Perez Flores
#3 Citlali Perez Lopez
#4 Diane Martinez-Gomez
#5 Francisco Muniz
#6 Gabriel H. Bermudez Sellars
#7 Hritanshu Rath
#8 Isaac Soria
#9 Jalynn Greer
#10 Jenifer Hernandez
#11 Joshua J.Rosario
#12 Kalina Rashkov
#13 Mabel Espinosa
#14 Margarito Avila
#15 Mario Paredez
#16 Marisol Hernandez Garcia
#17 Onyinyenchi R. Anogwi
#18 Rodolfo Galvan Nunez
#19 Ronald Nap
#20 Tiffany Gair
#21 Vinh-Dan Bao
#22 Yuki Yang
#23 Isaac Hernandez

Poster Presentations

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#1 Alejandro Montiel Torres
#2 Ana Lucia Loera Lafont Serrano
#3 Angelica Cardenas
#4 Ashley Ratcliff-Winn
#5 Baixi Guo
#6 Cynthia Saraid Zermeno Segoviano
#7 Daniel Lopez
#8 Deija Moore
#9 Destiney M. Marquez
#10 Gillian Morgan
#11 Jada Marshall
#12 Joshua Rotondo-Valentine
#13 Kanchana Khat
#14 Karla Ramirez
#15 Lauren Lopes
#16 Maribeth Krieg Puga
#17 Maximiliano Gonzalez Barba
#18 Niove Aragon Aragon
#19 Rebecca Serrato
#20 Rodrigo Flores
#21 Ryan Milstrey
#22 Valerie Zaira Pulido
#23 Christian Espinosa

SESSION D 1:00-1:45PM

#1 Aaliyah Ruiz-Corral
#2 Aarthika Nagarajan
#3 Alex Luu
#4 Annette Ruiz-Arreola
#5 Desiree Solis
#6 Donte' Williams
#7 Emily Rivera Mondragon
#8 Iliana Romero
#9 Kevin Geumham
#10 Logan Adrian
#11 Luisa Rincon Gramjo
#12 Maria Contreras
#13 Melisa R Lovos Palacios
#14 Morgan Malone
#15 Nathan Kamm
#16 Nisha Fletcher
#17 Sayra Lucas
#18 Shaan Dias
#19 Shang-Wen Stradleigh
#20 Thomas Kellogg
#21 Vania Huaranga
#22 Yu Fang Tseng
#23 Jazmin Vidal

Poster Presentations

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#1 Allyzza Raya
#2 Anaya Cambridge
#3 Citlali Ponce Torres
#4 Cynthia Navarro
#5 Eric Brooks
#6 Gyselle Alexandra Godinez Castillo
#7 Harismar Oberai
#8 Jackie Badillo
#9 Janette Molina Cuevas
#10 Jasmine Camacho
#11 Jesus De La Mora
#12 Juan Estrada
#13 Kaitlynn Totter
#14 Kayle Fox
#15 Lucy Karabedian
#16 Marcela Cardoza Cortes
#17 Michelle Escobar Landero
#18 Mirian Cruz
#19 Rida Mirza
#20 Rosio Bautista-Resendiz
#21 Socheata Hour
#22 Zeth Carmona
#23 Tammara Goebel

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105 Jefferson Yang
215 Marlene Marquez Villanueva
225 Bernardo Alberto Vargas Vidal

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205 Estefani Cruz Cruz
105 Joshua Ancheta
215 David Amezcua
225 Ivan Huirache Rodriguez

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205 Jeremy Reyes
105 Isaias Teran

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105 Linda Angelina Jerome
215 Leticia M. Ramos
225 Maylyn Ankary Torres

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205 Karen Tovar
105 Melvin Sanchez
215 Ria Jhala
225 Shelly Anne Abu

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205 Maria G. Reza
105 Baldemar Motomochi
215 Nyjah Robertson

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205 Laura Gonzalez Rodriguez
105 Viridiana Hernandez Juarez
215 Xuan Gip

SESSION C2 12:15-12:30PM

205 Josa Avila-Garcia
105 Darian Andrade-Diaz
215 Simone Graham

SESSION C3 12:30-12:45PM

205 Jasmine Aguirre
105 Hins Qui
215 Charles Rivera

BRAAG

Geoscience is one of the least diverse fields in the United States, even within STEMM (Science, Technology, Engineering, Mathematics, and Medicine). The University of California (UC), Merced – Historically Black College and University (UCM-HBCU) partnership - “Boosting Representation of African-Americans in the Geosciences” (BRAAG) - aims to contribute to changing the trajectory of representation of African-Americans (AA) in the geosciences in the UC system and beyond.

The BRAAG partnership is a three-year program intended to improve the representation of Black people in the geosciences by recruiting students from three HBCUs - Kentucky State University, Tennessee State University, and Howard University. At UC Merced, we will provide HBCU students with an immersive and enriching research experience over eight weeks, along with multi-tiered mentoring and sponsoring of the students we recruit long after they complete their summer research at UC Merced.

Jalynn Greer
CCBM

Comparing Nitrogen Dynamics in the Alley and Berm in an Almond Orchard
By: Jalynn Greer, Elena Bischak, PhD Candidate, Brendan Harrison, PhD Candidate, Dr. Rebecca Ryals, PhD

This study investigates the effect of biochar application of soil greenhouse gas emissions and soil nitrogen dynamics in an almond orchard in Madera, CA. This study is important because large cultivation of almond orchards has been weakening the health of soil and the environments around the area. It is important because soil carbon can fight climate change. The soil experiences access issues, due to natural, chemical, and physical activity. Two biochar preparations (almond shell and almond pruning) will be applied at two application rates respectively and Soil samples will be taken periodically to measure soil available nitrogen, and greenhouse gases will be measured in-field with a Picaro G2508 gas analyzer. The study should predict how biochar application impacts soil nitrogen dynamics and soil GHG emissions. Biochar demand could lead to benefits that would affect climate change.

Simone Graham
CCBM

Rapid Soil Microbial Response to Wetting Events
By: Simone J. Graham, Teamrat A. Ghezzehei

Recently, the interest in soil organic matter has increased because it is recognized that soil is the largest reserve of carbon. Therefore, it has the potential of slowing down climate change if loss of carbon from soil is slowed down. One of the unusual discoveries of soil respiration in the last half century is that the rate of CO2 loss from soil increases drastically immediately after wetting. The increased rate lasts only for a short time and decreases even if the water content does not go down. This research aims to answer whether the temporary increase of respiration can be explained by the fact that both water and oxygen are abundant for a short time immediately after wetting. In phase 1, soil samples were saturated with water at room temperature. The main treatment will receive water that has been deoxygenated. The control will be identical quantity water applied in the same manner, but with natural oxygen concentration. It is expected that the respiration of the samples wetted with tap water will be higher initially. Once the initial oxygen is depleted, the respiration in both treatments will be identical because the oxygen is supplied in both treatments by slow diffusion throughout the soil pore water. In other words, the more dissolved oxygen in water equates to a larger response in microbial activity (higher initial spike in CO2).

CAMP

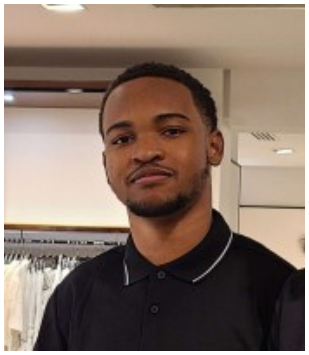
The following student scholars are participants in UC Merced's CAMP program. The Louis Stokes California Alliance for Minority Participation (CAMP) in Science, Technology, Engineering and Math, is a statewide initiative funded by the National Science Foundation (NSF) to strengthen the quality and quantity of underrepresented students receiving baccalaureate degrees in science, technology, engineering and mathematics studies at the University of California (UC). CAMP offers extensive resources and unique opportunities for students to excel in their respective fields of study. The CAMP program began at UC Irvine in 1991; currently, nine UC campuses participate in the program.

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

Andrew Valdivias
CAMP

Shape-induced deformation by bistable non-spherical domes
By: Andrew Valdivias and Francesco Danzi, Ph.D.

Metasheet with patterings of bistable units, consisting of spheric elastic domes, allows the control of macroscopic geometric frustration, the design of metamaterials with encoding and memory capabilities, and enables shape morphing. In particular, shape morphing is achieved by leveraging the deformation of the region surrounding the inverted domes. Arguably, non-spherical domes represent a valid alternative, potentially enabling a higher degree of tunability of the deformation induced in the metasheet compared to their spherical counterpart. This work aims to investigate the deformation induced by a tessellation of bistable non-spherical domes and its dependency on the order by which the bistable domes are inverted.



Donte' Williams
CAMP

Use of PCBs in current and voltage sensing of electrical vehicles and batteries
By: Donte Williams, Ricardo Pinto de Castro PhD, Iman Ebrahimi

A Printed Circuit Board (PCB) is a rigid structure that connects electronic components in a controlled manner. Some applications of PCBs are computers, cell phones, fridges, etc. In my research project we focused on monitoring the current, voltage, and temperature of robotic vehicles and batteries. My objective was to expand the original monitoring PCB to also include detection of both high and low currents in both robotic vehicles and batteries. These PCBs can help better optimize these vehicles since speed is dependent on voltage input and too much strain on a battery can led to malfunctions or worst-case explosions. From documentation on the sensors used in the PCBs we should be able to get around 0.8% - 1.25% margin of error on the current. In conclusion we are able to have a better read on the input and output of these vehicles and the strain on their batteries to better optimize them as we progress.

Elia Lopez
CAMP

Effects of CBD on the Activation of Cardiac Protein Kinase B in a Rat Model of Metabolic Syndrome

By: Daisy R Zapet Bamac, Elia G Lopez, Jessica Wilson, Dora A Mendez, MS, Rudy M. Ortiz Ph.D.

The activation of protein kinase B (AKT) is a critical step in the post insulin receptor signal transduction. In cases of insulin resistance, glucose uptake is reduced when insulin fails to properly promote its receptor-mediated signal transduction. Insulin resistance is a component of the metabolic syndrome (MetS), which is a contributing factor of cardiovascular disease (CVD). While recent studies on the medicinal effects of cannabidiol (CBD) suggest it can ameliorate risk factors of CVD, its effects on glucose metabolism in the heart are less understood. To investigate this, the Otsuka Long Evans Tokushima Fatty (OLETF) rat, a model of MetS, and its healthy strain-control, the Long Evans Tokushima Otsuka (LETO) rat, were used. Rats were assigned to three groups (n=8/group): (1) untreated LETO, (2) untreated OLETF, and (3) OLETF + H4CBD (200mg/kg/day x 4 weeks). Because CBD has been shown to improve glucose tolerance, we expect it to increase the phosphorylation (activation) of AKT in the heart. This study will give insight into the effect of CBD during metabolic syndrome to further investigate effects on glucose metabolism. Key Words: Cannabidiol (CBD), Metabolic Syndrome, AKT, Obesity, Insulin Resistance

Francisco Muniz
CAMP

Effect of an exogenous thyroxine treatment on cardiac phosphorylation of the insulin receptor in obese insulin resistant Otsuka Long Evans Tokushima Fatty rats.

By: Francisco Muñiz, Dora Mendez MS, Rudy M. Ortiz PhD

Metabolic syndrome (MetS) increases the susceptibility for the development of cardiovascular disease (CVD) and type 2 diabetes (T2D). In T2D insulin resistance is one of the main factors that drives the complications of this disease. The insulin receptor, a receptor in the family of tyrosine kinases, contributes to the uptake of extracellular glucose into cells. The binding of insulin allows for a conformational change, which phosphorylates the receptor and starts a cascade of signals that leads to the translocation of glucose transporter type 4 (GLUT-4) via vesicles. When embedded into the membrane, GLUT-4 facilitates the uptake of glucose. During insulin resistance this process is hindered as insulin cannot properly bind to its receptor and/or initiate a proper intercellular signal. The thyroid hormone, thyroxine (T4), can increase metabolism by binding its receptor and initiating the transcription of GLUT-4. Using a rat model of MetS, the OLETF, we chronically treated animals with T4 (8 µg/100g BM/d × 5 weeks) and measured the expression of phosphorylated insulin receptor in the heart. My hypothesis is that exogenous T4 would increase the phosphorylation of the insulin receptor in the hearts of both (OLETF) and lean Long Evans Tokushima Otsuka (LETO) rats.

Janette P. Molina Cuevas
CAMP

Microbiome Reduction in Exaiptasia pallida: The Effects of Antibiotic Solutions on Host Fitness and Cellular Respiration

By: Janette P. Molina Cuevas, Sophia MacVittie, E. Maggie Sogin, PhD

Exaiptasia pallida, commonly referred to as Aiptasia, is a sea anemone that harbors microbes in its tissues, including the dinoflagellate algae in the family Symbiodiniaceae. It is thought that the Aiptasia microbiome is essential in preserving a healthy immune system and adequate levels of nutrient cycling; however, only a limited number of microbes associated with Aiptasia have been characterized, and by large their functions remain unknown. We hypothesize that by maintaining Aiptasia with and without algae, in varying concentrations of antibiotic solutions, we will be able to effectively reduce their microbiome and analyze how disrupting the microbiome impacts the host. Host morphology, cell health, and cellular respiration will be monitored to identify sudden and gradual changes. Specifically, cellular respiration will be analyzed by performing a citrate synthase assay, which will allow us to quantify the impacts of the antibiotics on mitochondria. We expect that the host will face more detrimental health effects the higher the concentration of antibiotics as citrate synthase activity will be significantly reduced. In the future, through our analysis and 16S sequencing, it will be possible to conclude what bacteria was successfully knocked down, which will be helpful in developing gnotobiotic anemones.

Jonathan Leon-Ricos
CAMP

Long-term oxygen level prediction via machine learning for agricultural managed aquifer recharge

By: Jonathan Leon-Rios

Agricultural managed aquifer recharge (AgMAR), which refers to applying extra surface water to croplands to recharge groundwater level, has been adopted as a pivotal strategy of sustainable water management and groundwater conservation. However, the efficiency and safety of AgMAR execution remains a research question, of particular importance is the oxygen level in the root zone, serving as a key indicator for the crop health. Existing empirical methods are inadequate in tackling this challenge, primarily due to the complexities of varying oxygen level with varying environmental conditions, resulting in either a low efficiency in water usage or high risk for root health of crops. This project introduces a data-driven approach to soil oxygen level prediction for AgMAR with advanced machine learning techniques. Specifically, we use a recurrent neural network (RNN) model to learn from past time-series, as well as utilizing the meteorological weather condition as clues, to identify how the soil oxygen level would change in the long-term future. The evaluation shows that the model achieves accurate predictions with the mean square error of about 1% on a real dataset collected in an alfalfa field. The unique contribution of this research is revealing the potential for time-series-aware machine learning models to provide accurate oxygen level prediction as a reference for the water applying decision-making.

Lina B-Hernandez
CAMP

Mechanical Metamaterials with Aperiodic Tiles
By: Lina B-Hernandez ad Francesco Danzi, Ph. D.
Metamaterials are engineered materials designed to exhibit properties that are rarely observed in naturally occurring materials. Metamaterials' properties derive from the shape and arrangement of their small-scale units, the so-called meta-atoms. Although, meta-atoms are commonly arranged in repeating patterns, aperiodic lattices resembling quasicrystals have emerged as a viable alternative to attaining intriguing mechanical properties including machine-like behavior, shelf-shaping, and morphing capabilities to mention a few. In this work, we investigate the mechanics of a newly discovered "einstein", i.e. a 13-sided monotile that lacks of translation symmetry. We observed experimentally that such re-entrant structure exhibit a null Poisson's ratio rendering the metamaterial suitable for packaging, aerospace, and biomedical applications.

Lucy Karabedian
CAMP

Environmental Neurotoxins Effects on Neuronal Networks and Synaptic Mechanisms
By: Lucy Bella Karabedian, Morgan Sono, Ramendra N. Saha PhD
Endocrine-disrupting chemicals (EDC) disrupt activity-dependent signaling necessary for immediate early gene (IEG) transcription in developing neurons. Here we show that 6OH-BDE-47(a hydroxylated metabolite of PBDE-47; a commercially used flame retardant) and BPA (a ubiquitous plasticizer) disrupt activity-dependent Arc (model IEG) transcription. The toxins were administered to primary cortical neuronal cultures at different doses and developmental ages with either bicuculline - to measure synaptic signaling, or Tetrodotoxin (TTX) and phorbol myristate acetate (PMA) in tandem - to induce MAPK intracellularly through PKC. Arc pre-mRNA levels were then amplified by one-step RT-PCR using intron-spanning primers and quantified by qPCR. Data demonstrates a dose-dependent attenuation in Arc induction in both MAPK activation models. This finding brings into question how MAPK- which is necessary and sufficient to rIEG induction - is attenuated by such toxins. We believe this attenuation in Arc transcription may be explained by the structurally unhindered OH groups in these compounds, which may potentially disrupt phase-separating behaviors at the synapse and/ or nucleus. IEGs are significant because they rapidly activate in response to environmental changes and exposure to these environmental toxins may disrupt synaptic plasticity. The mechanisms which these toxins may disrupt are elusive and begs for further investigation.

Mirian Cruz
CAMP

Determining Whether Bacteriophages Impact Intestinal Epithelial Internalization of Bacteria

By: Mirian N. Cruz, Ambarish Varadan, Juris A. Grasis, PhD

Bacteriophages are the most abundant viruses in the human gastrointestinal tract. Previous studies have shown that bacteriophage populations are altered in individuals with inflammatory bowel disease (IBD), specifically an increase in Caudovirales bacteriophages within the intestine of individuals with Crohn's disease (CD) and ulcerative colitis (UC). However, despite their abundance in the intestinal mucosa, the impact of bacteriophages on intestinal immunity has not been investigated in detail. We hypothesize that bacteriophages would heighten the bacterial invasion of HT-29 cells. We used gentamicin protection assays to determine whether filamentous bacteriophages M13 and Fd impacted the ability of Escherichia coli to invade intestinal epithelial cell line HT-29. By shedding light on the tripartite interactions between bacteriophages, bacteria, and the human host, we aim to offer invaluable insights into this intricate relationship.

Rosio Bautista-Resendiz
CAMP

Assessing Antibiotic Dosage impacts on the Aiptasia Microbiome

By: Rosio Bautista-Resendiz, Sophie MacVittie, Maggie Sogin, PhD

Coral reefs are in decline due to an increase in temperature and pollution. The sea anemone, Aiptasia, is frequently used as a model for corals because it hosts the same symbionts as its cnidarian relative, however it is much easier to work with in the lab. Here, we are interested in determining the role of Aiptasia's bacteria because of its connection in supporting host health. In this study, I exposed Aiptasia to different concentrations of antibiotics to determine which concentration can diminish the microbiome without negatively impacting the host. We imaged each anemone throughout the experiment to monitor the impacts of the dosage that is best for microbiome knockdown. In parallel, we extracted the RNA from individual anemones and synthesized cDNA in preparation for qPCR of the 16S rRNA gene to determine bacterial load at each dosage level. We expect that the abundance of bacteria will change according to the different concentrations of antibiotics. Future work will investigate shifts in the community composition of the microbial community as a function of the antibiotic concentration using 16s rRNA amplicon sequencing. These initial steps will allow us to generate a gnotobiotic Aiptasia model that will allow us to perform re-inoculation experiments.

CCBM C-sip

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.

David H. Amezcua
CCBM C-Sip

Beads Coated with a Functionalized Synthetic Lipid Bilayer as Promising Biosensors
By: David H. Amezcua, Christopher J. Randolph, Eva de Alba, PhD

Functionalized beads are used in a broad range of biotechnological applications, including separation, detection, and immobilization. However, the functional moieties cannot move across the bead surface, which is a desirable property as dynamics are key for many biological processes. For example, the oligomerization of surface receptors in the cell membrane controls the detection of extracellular stimuli and the transmission of amplified signals across the membrane. Here, we aim to add dynamic properties by coating beads in a functionalized synthetic lipid bilayer containing fragments of a cell surface receptor. The bilayer fluidity should allow receptor oligomerization and thus signal amplification. As proof of concept, we are using several domains of the cell surface Receptor for Advanced Glycation End-products (RAGE). This protein prompts an inflammatory signaling pathway upon the detection of a variety of cellular insults. RAGE's function strongly depends on its oligomerization; thus, we aim at showing RAGE oligomerization in the synthetic membrane-coated beads upon ligand binding. These "fluid mosaic-coated beads" can be used as biosensors for signal amplification and for biophysical studies of membrane receptor oligomerization and its effect on signaling.

Eric Brooks
CCBM C-Sip

Probing Folding Mechanisms via Advanced Single-Molecule Fluorescence Experiments
By: Eric G. Brooks, Catherine Ghosh, PhD; Mourad Sadqi, PhD; Victor Muñoz, PhD

The ability of proteins to fold into dynamic 3D structures allows for diverse cellular functions and the rates of (un)folding are key to understanding their mechanisms. Protein (un)folding rates can be interpreted as diffusion on a projected, low dimensional free energy surface (FES). Kramer's rate equation shows that the rates depend on characteristics of this FES. It has been observed in simulations that (un)folding transitions involve energetically and mechanistically heterogeneous pathways. It is unclear if proteins fold by one macroscopic pathway or by using multiple pathways. We will investigate this using single-molecule FRET experiments with maximum likelihood analysis of time stamped photon trajectories with a diffusive free energy model (FES-MLA-PT). Our protein of interest is the fast-folding protein gpW. We will use FRET pair configurations to measure pairwise distances between three secondary structure elements of gpW. To probe different distances in gpW we will place the FRET pair (Alexa Fluor 488 and Alexa Fluor 594) in three configurations (N-term-C-term, N-term-middle, and middle-C-term). Labeling will be done via standard thiol-maleimide chemistry. These experiments will dissect the rates as a function of three intra-protein distances and resolve the structural heterogeneity of the mechanisms. This offers an opportunity for experimentalists to extricate information on folding pathways at a detail previously only accessible through simulations.

Harsimar Oberai
CCBM C-Sip

Targeting Glycosylation Sites on SARS-CoV-2 Spike Protein for the Development of Therapeutic Strategies

By: Harsimar S Oberai, Wenyan Guan; Patricia J LiWang

The emergence of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in late 2019 initiated an urgent scientific response as it became responsible for a worldwide pandemic with limited treatment. The interaction between the virus and its host is of paramount importance for devising effective therapeutic strategies to combat this global health crisis. The entry of SARS-CoV-2 into human cells relies on the binding of its spike (S) protein to angiotensin-converting enzyme 2 (ACE2) receptors present on the surface of host respiratory cells. On the (S) protein there are twenty two glycosylation sites which aid in immune evasion and viral entry. Our hypothesis suggests that removing individual or grouped glycosylation sites could impact the infectivity of the S protein, thereby identifying potential therapeutic targets. We will use 2-step PCR to mutate multiple glycosylation sites individually, as well as induce double and triple mutations on neighboring sites, to investigate their effects. The designed mutations involve replacing the asparagine (N) amino acid with glutamine (Q), which have similar chemical structures, resulting in an S protein that retains its overall structure while lacking glycosylation. Therefore, the mutations will show specifically the effect of glycosylation at that site on the infectivity of the virus.

Jasmine Aguirre
CCBM C-Sip

Stem Cell Reprogramming of Oral Epithelial Cells “Buccal Cells"

By: 1 Jasmine Aguirre, 2 Jose E. Zamora, 2 Kara McCloskey Ph.D. 1

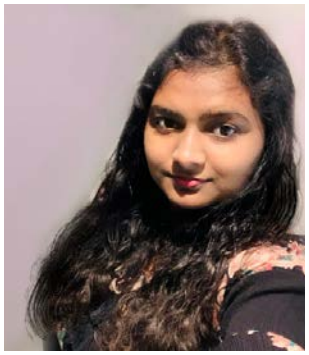
Induced pluripotent stem cells derived from somatic cells have immense potential to be used as a platform to study therapeutic regenerative medicine and as a patient-specific disease model. This is because most cells within our bodies have a very specialized function and have lost many of their initial functions with aging. Thus, by developing a robust and non-invasive method for generating unlimited amounts of stem cells we may one day enable researchers and doctors to treat disease with a patient’s own derived stem cells. Here, we experiment with oral epithelial cells “buccal cells” instead of other cells that require more invasive collection procedures. To reprogram buccal cells into stem cells, we will use the CytoTune-iPS reprogramming system that uses replication incompetent Sendai virus (SeV) to safely deliver and express the Yamanaka genetic factors required for reprogramming cells. However, one key challenge that must first be overcome is to successfully culture these somatic cells within traditional tissue cultures. Here we report the advancements we have made in achieving this goal.

Keywords: Stem cells, Epithelial cells, reprogramming, adhesion.

Kalina V. Rashkov
CCBM C-Sip

Three-dimensional bacterial transport in microscale structures
By: Kalina V. Rashkov, Pooja Chopra, PhD; Bin Liu, PhD

Swimming bacteria often encounter microscale structures such as polymer networks and micro-patterned surfaces in their living habitats. Despite these detailed structures being crucial to many medical and ecological processes, the 3D nature of such cell-structure interaction remains underexplored, mostly due to the challenge of imaging through conventional 2D microscopy. In this study, we focus on the 3D feature of microstructures with controlled geometries, here, an array of micropillars on a quasi-2D lattice. The axial dimension in cell-structure interactions is resolved by implementing an automated tracking microscope with fluorescence capability: fluorescence images of bacteria in micropillar arrays are captured and analyzed in real-time to control the microscope stage for tracking individually labeled cells. Using green fluorescent protein-expressing (GFP) Escherichia coli as an archetype, we show that the automated microscope can follow individual bacteria as they navigate the micropillars and thus resolve the full 3D trajectories, despite the complex pattern of the surrounding microscale structures. Besides the dependence on the distance to individual pillars, we also show how such bacterial transport depends on their elevation from the neighboring substratum, as an essential 3D feature in such cell-structure interactions.



Linda A. Jerome
CCBM C-Sip

Navigation of bacteria in quasi-two-dimensional microstructures
By: Linda A Jerome; Pooja Chopra, PhD; Bin Liu, PhD

Interactions between bacteria and patterned microstructures have been attributed to a whole host of bacterial behaviors, associated with distinct biofouling and antifouling effects of structured environments. Previous studies have shown that an array of micropillars may either trap individual bacteria Escherichia coli or enhance their diffusivity through geometric effects, with a surprisingly anomalous dependence on cell sizes. Besides the geometries of pillar patterns, these bacteria are also subjected to the top and bottom confining walls, introducing additional 3D effects. To show how the confining walls alter the geometric effects of pillar arrays, we vary the height of micropillars while keeping them on the same lattice pattern. By following individual bacteria as they navigate in micropillars of various heights, especially short pillars as quasi-two-dimensional confinements, we understand how this additional geometric feature (set by pillar heights) affects the 3D cell-structure interaction and thus the long-range transport of bacteria in complex structured media.

IoT4AG

Our Mission is to create and translate to practice Internet of Thing (IoT) technologies for precision agriculture and to train and educate a diverse workforce that will address the societal grand challenge of food, energy, and water security for decades to come.

Monitoring of agricultural crops is still accomplished primarily through the expensive, labor-intensive, and time-consuming process of crop scouting, by manual sampling and documenting the state of the field. Precision agriculture involves the use of technology to acquire and analyze data from the field. While the concept of precision agriculture has existed for 30 years, the exponential growth in information technology and data science and the reduction in their cost is setting the stage for the next revolution in agricultural practices.

IoT4Ag projects in the Yeo and Keske labs examine the socio-economic impacts and opportunities of physical and cyber-physical system enabled precision agriculture. For more info visit https://iot4ag.us

Calvin Hoang
IoT4AG

Machine Learning Approach for Analyzing Digital Agriculture Literature: Uncovering Data-related Themes Impacting Decision-making

By: Calvin Hoang, Steven Sun, Dr. Lisa Yeo

With the surge of Big Data and Internet of Things (IoT) devices, farmers and other stakeholders of the agriculture industry can leverage real-time analytics to optimize their productivity and minimize waste. However, growers are hesitant to digitize their farms due to uncertainty in the data business model. I developed an ML approach to classify digital agriculture literature related to decision making. This approach involves using natural language processing techniques to tokenize and sort through articles. Through sorting these articles, I identify factors that influence decisions to adopt, how data impact operations, and data sharing. In a previous work, I sorted through and identified relevant themes that are in these papers. In this I work I sorted through to identify themes relating to data.

NASA Kelpfire

Wildfire Impacts on Watershed Transport of Carbon to Coasts

This project aims to quantify how wildfires alter particulate organic carbon and sediment fluxes to the California coast, and how these fluxes impact coastal kelp forest distributions and productivity along the California Current system for the 2000-2020 study period.

NASA's Minority University Research and Education Project (MUREP) Ocean Biology and Biogeochemistry, or OCEAN, has awarded grants to 10 universities for projects that will support NASA's Science Mission Directorate in seeking a better understanding of the ocean's role in the Earth system.

Charles Rivera
NASA Kelpfire

Revealing Plant Traits in Water Primroses through Remote Sensing Plant Spectroscopy: Insights into Habitat Invasion

By: Charles F. Rivera, Bailey Morrison PhD, Erin L. Hestir PhD

Water primroses are invasive floating macrophytes that have the potential to significantly alter the biophysical and ecological characteristics of the habitats they invade across the globe. As they spread from open water to terrestrial environments, water primroses not only displace and outcompete native species but also hinder conservation efforts. However, there is a lack of comprehensive research on the differences in traits exhibited by water primroses in aquatic and invasion-front habitats. This study aims to investigate these differences by utilizing plant spectroscopy data collected between the summer of 2021 and spring of 2022 from both aquatic and invasion front water primroses in the San Joaquin Delta. Plant spectroscopy offers an efficient and robust alternative to the traditional time-consuming and expensive in-situ laboratory analysis. By applying spectral comparison techniques such as Euclidean distance, spectral angle mapper, and Jeffries-Matusita distance to name a few, this study will investigate quantitative measurements that contribute to assessing habitat vulnerability and identifying invasion strategies. The expected results will reveal potential spectral differences between aquatic and invasion front water primroses, facilitating the identification of plant traits that drive habitat invasion. This improved understanding may inform the development of new conservation and restoration practices aimed at mitigating habitat mortality.

Physics REU

NSF funds a large number of research opportunities for undergraduate students through its REU Sites program. An REU Site consists of a group of ten or so undergraduates who work in the research programs of the host institution. Each student is associated with a specific research project, where he/she works closely with the faculty and other researchers.

The UC Merced Physics REU supports student in research projects at the forefront in the sub-fields of biophysics; condensed matter and solar science; atomic, molecular, and optical physics and quantum optics; nonlinear dynamics; soft condensed matter; and astrophysics.

Brooke Olson
Physics REU

Oscillatory Mechanical Perturbations in Active Fluids: Probing Dynamic Properties and Resonant Behavior

By: Brooke E. Olsson1, Derek Hammar2, Shahirin Shahida2, Linda Hirst2

Active fluids can be created from reconstituted biological molecules which convert chemical energy into mechanical energy. These self-propelled fluids have garnered significant interest from the scientific community, due to the collective behavior of their constituents and dynamics that resemble ideal mixing patterns. Studying these systems allows us to gain further understanding into their dynamic properties and how we can design a deterministic system. The objective of this research is to introduce mechanical oscillations to the active fluid and observe the resulting behavior. We will attempt to oscillate the system at different frequencies using a variety of piezoelectric actuators while using fluorescence microscopy to observe the system. By subjecting the active fluid to mechanical perturbations, we aim to probe how the systems responds and whether a resonant frequency can be determined. The results of this research will contribute to our fundamental understanding of active fluids and their response to mechanical perturbations. Additionally, methods developed in this experiment can be used in future micro-fluidic systems.

Kevin Geumhan
Physics REU

The parameter lambda's role in defects' behavior within active material systems

By: Kevin Geumhan, Md. Mainul Hasan Sabbir, Dan Beller, Spencer Smith, and Kevin A. Mitchell

The study of active materials concern non-equilibrium fluids composed of rod-like subunits with head-tail symmetry, which can generate large-scale, self-driven flows converting local internal (e.g. chemical) energy into large scale mechanical energy. In turn, that process generates a self-stirring fluid. One prominent example of an active material utilizes rod-like microtubules—components of the cytoskeleton—and kinesin molecular motors. The microtubules are densely packed in a 2D layer, and form an ordered nematic phase. The kinetic motors cross-link the microtubules and cause them to slide relative to one another creating an extensile flow. The nematic phase has point-like topological defects that braid around one another in a typically chaotic fashion. These defects can be viewed as virtual stirring rods that are responsible for stirring the fluid. The geometric shape of the subunit—in this case microtubules—play a crucial factor in determining whether the defects will behave periodically. Within the study of active materials, the geometric shape of the particle is represented by the parameter lambda. To understand the importance of the geometric shape of the particle and its role in defect behavior, we varied the lambda parameter. We observed that when lambda is around 0.6, there is a transition from chaotic motion of defects to periodic behavior. This discovery is crucial because it shows that if lambda is decreased enough, the periodic behavior of the defects will disappear. Thus,

Leticia M. Ramos

Physics REU

Effect of Fine Structure Constant on Lattice Constant and Thermal Expansion of Crystalline Silicon, as a Probe for Dark Matter

By: Leticia M. Ramos, Arabi Seshappan, MS, and David A. Strubbe, PhD

The fine structure constant is one of the most fundamental constants of nature. It has no units and is equal to roughly 1/137. Dark matter theorists have hypothesized that dark matter may cause the fine structure constant to vary. So far experiment has found no variation in the fine structure constant based on atomic spectroscopy. The question has arisen whether the fine structure constant affects the size of the gratings through the lattice constant of the material. The purpose of this study is to investigate the influence of variation of the fine structure constant on the lattice constant and thermal expansion of crystalline silicon. This computation was done with the code Octopus utilizing Density Functional Theory. We can vary the fine structure constant by tuning the strength of relativistic effects like spin-orbit coupling, both on the core and valence electrons. These results could reveal new experimental signatures of fine structure variation and provide information on other effects that should be included in spectroscopic studies searching for the effects of dark matter.

Nisha Fletcher

Physics REU

SnTe as a Topological Crystalline Insulator

By: Nisha Y. Fletcher, Bamidele Onipede, Physics; Hui Cai PhD

Topological crystalline insulators (TCIs) are unique materials with an insulating bulk and gapless edge states and are protected by crystal symmetry. The first experimental realization of a 2D TCI is Tin telluride (SnTe), which holds promise for thermoelectric, ferroelectric, ferromagnetic, and superconductive applications. By doping 2D materials, the optical, magnetic, electrical, and topological properties could be tuned. In this study, we employ Chemical Vapor Deposition (CVD) method to synthesis and achieve doping of SnTe on various substrates. We investigate the effects of sulfur doping on the ferroelectric properties of (sulfur doped) SnTe. Characterization techniques such as Raman spectroscopy, X-Ray Photoelectron Spectroscopy (XPS), and Atomic Force Microscopy (AFM) are employed. Successful doping experiments have been conducted with SnTe and SnS. This study contributes to understanding the properties and growth mechanisms of SnTe, with implications for novel materials.

Ria Jhala
Physics REU

Elonization of Graphene at High Electron Temperature as a First Stage of Plasma Formation

By: Ria J. Jhala, Tobias Zier, PhD, David A. Strubbe, PhD,

High temperatures and pressures induce exotic plasma states of matter where electrons are separated from the ions. These conditions can be found in nature (e.g., our sun), but also play a crucial role in experiments on inertial confinement fusion as a future energy source. Plasmas have been thoroughly studied but the microscopic mechanisms of their formation remain uncertain. One stage is in the response to an incident laser is an increase in the temperature of electrons within a material, which will cause ionization. Here, we use density functional theory calculations in the Octopus code to study ionization due to electron temperature in graphene, a layer of carbon atoms arranged in a hexagonal lattice. We computed the electronic density for various electronic temperatures, which control the electronic occupations through the Fermi-Dirac distribution, to assess the degree of loss of electron density to the vacuum. This result will help to further understand the formation of plasmas in materials under extreme conditions, which help with the optimization of inertial confinement fusion experiments.

Shaan Dias
Physics REU

Synthesizing a Magnetic Topological Insulator Using Chemical Vapor Deposition

By: Shaan Dias, Matthew Metcalf, Hui Cai, PhD

Magnetic topological insulators have electronic and magnetic properties that are of interest to condensed matter physicists for potential applications in fields such as quantum computing and spintronics. In this work, we will synthesize Mn-doped Bi2Te3 using chemical vapor deposition (CVD) and characterize the resulting crystals using optical microscopy, Raman spectroscopy, and X-Ray Photoelectron Spectroscopy (XPS). We will study the effects of varying multiple parameters during the CVD process including temperature, presence of salts, types of carrier gases, substrate position, and more in an effort to produce high quality crystals in a scalable and reliable manner. Refining a CVD process to eventually produce crystalline MnBi2Te4 would mark a crucial step toward making this material a viable candidate to use in future projects that will help bring forth the next generation of quantum technologies and high-performance electronic devices.

Shang-Wen Stradleigh
Physics REU

Generating Entangled Photons with Birefringent Fibers

By: Shang-Wen Stradleigh, Albert DiBenedetto, Jay Sharping, PhD

We aim to characterize Four-Wave Mixing and generate entangled photons through the utilization of birefringent optical fibers. By investigating classical phase-matched four-wave mixing, we can produce photon pairs that are highly correlated (entangled), where these properties have useful applications in qubits and quantum communications. In our investigation, we employ the HBXXX family of fibers pumped by a Ti:Sapphire laser at 800nm, with a particular focus on the HB800G. The generation of stable, coherent entangled photons from birefringent fibers will prove to be valuable as a source for photon counters in future experiments and will align with prior research conducted by other groups.

Xuan Gip
Physics REU

Understanding the mechanical responses of microtubules

By: Xuan Gip, Dr. Jing Xu, PhD

Microtubules play a critical role in defining the shape and functionalities of many cellular structures. Experimenting the extent of their durability can help us better understand their part in cells and as well as being crucial for other uses like mechanosensory. In this experiment done with Dr. Jing Xu, we want to know how microtubules respond to mechanical compression or pulling. We observed this by optically trapping the microtubules while simultaneously measuring the applied force along with the resulting filament strain. By analyzing through MATLAB how the microtubules respond to applied forces across a range of driving frequencies, we hope to get a better understanding of their mechanical properties, which can give us great insight on the properties of various biological structures and functions.

RESUME Applied Math

The National Science Foundation has awarded the UC Merced Department of Applied Mathematics a five-year award to establish the Data-Intensive Research And Computing (DIRAC) Research Training Group (RTG) focused on the theme of Computational and Data-Enabled Sciences. The Research Experience Summer Undergraduate Mathematical Explorations (RESUME) in Data Science program is one part of this DIRAC RTG focused on training undergraduate researchers in computational and data-enabled sciences. RESUME students participate in solving a real-world data-based problems (e.g. computer vision, UCM education trends, misinformation detection, etc) as part of a team during the UROC Summer Undergraduate Research Institute for research engagement and graduate school preparation.

Alondra Maravilla
Resume

A Simple Convolutional and Residual Neural Network for Super Resolution
By: Ryan Milstrey*, Hritanshu Rath*, Luis Fujarte*, Alondra Maravilla*, Kyle Wright*; Cory McCullough*

Super resolution techniques play a crucial role in enhancing images and have a wide array of applications, from security analysis to medical imaging to military surveillance. This research explores methods to improve models for enhancing the resolution of low-quality images. Specifically, we investigate the effectiveness of Convolutional Neural Networks in preserving information and enhancing fine details. Additionally, the analysis of the accuracy of the neural network was conducted using Fourier analysis along with more conventional metrics such as mean squared error. The research objective is to advance the performance of super resolution models by leveraging these techniques. To implement these machine learning techniques, we utilize the Python PyTorch library to train the model on many sets of low resolution images accompanied by their high resolution counterparts. This model generates an image with four times the resolution as that of the low resolution image, while refining details and maintaining the same underlying information.

Biaxi Guo
Resume

Synthetic data-driven approaches to evaluate Convolutional Neural Network (CNN) Robustness
By: Ronald Nap, Cristian Espinosa, Baixi Guo, Kyle Wright, PhD Candidate; Cory Mccullough, PhD Candidate

Accurate and robust machine learning models are often used when solving complex tasks. However, these methods require large amounts of data which poses a challenge due to the scarcity of data. This study involves 3 stages, first we synthesize data via a Generative Adversarial Network (GAN) to supplement a limited amount of data. Next, the accuracy and robustness of our CNN models are compared where one is trained on authentic data and the other trained on synthetic data. Subsequently, we investigate the optimal split between synthetic and authentic training datasets to assess the accuracy and robustness of our model utilizing synthetic data. Robustness refers to how a model's accuracy changes with new data or perturbed data. We are introducing synthetic data into the study. So far, we have synthesized the datasets and plan to conduct experiments with the proposed methods in the future. While the work is still in progress, we anticipate that the synthetic dataset will impact the robustness of a CNN model.

Conor Olive
RESUME

Reducing Inter-District Inequality as a Constrained Multi-Objective Optimization Problem

By: Gabriel H. Bermudez, Hyun-Jeong Lee, Conor E. Olive, Cory McCullough, Kyle Wright

As a result of Milliken v. Bradley, segregation between school districts remains high due to ``white flight''. Where permitted, decision makers who wish to alleviate inter-district inequalities may choose to do so through redrawing districts. Alleviation of school segregation can increase educational opportunities for affected students and provide students a more nuanced view of the world. In this paper, we propose a model of this problem solved as a constrained multi-objective optimization problem using sequential quadratic programming. We assume that each district is internally homogeneous. The model considers students' movement between districts as independent variables in a nonlinear objective function. Inside our objective function, we consider district-level variables, such as racial distributions, and measure their mean squared deviation (MSD) from all students across all districts. In addition, we impose a linear constraint to restrict movement between districts with shared boundaries, and a nonlinear constraint to limit the percentage of students moved. Applying our model to districts in Alameda County, with a 15% constraint on the number of students allowed to move, reduced the mean population-weighted MSD for racial distribution by 83.1%, from 0.12 to 0.02, showing the promise of this model.

Christian Espinosa
RESUME

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Hritanshu Rath
RESUME

A Simple Convolutional and Residual Neural Network for Super Resolution

By: Ryan Milstrey, Hritanshu Rath, Luis Fujarte, Alondra Maravilla, Kyle Wright; Cory McCullough

Super resolution techniques play a crucial role in enhancing images and have a wide array of applications, from security analysis to medical imaging to military surveillance. This research explores methods to improve models for enhancing the resolution of low-quality images. Specifically, we investigate the effectiveness of Convolutional Neural Networks in preserving information and enhancing fine details. Additionally, the analysis of the accuracy of the neural network was conducted using Fourier analysis along with more conventional metrics such as mean squared error. The research objective is to advance the performance of super resolution models by leveraging these techniques. To implement these machine learning techniques, we utilize the Python PyTorch library to train the model on many sets of low resolution images accompanied by their high resolution counterparts. This model generates an image with four times the resolution as that of the low resolution image, while refining details and maintaining the same underlying information.

Hyun-Jeong Lee
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Isaac Soria
RESUME

Optimizing Stock Portfolios: Exploring Modern Portfolio Theory with Efficient Frontier Curves, Random Sampling Portfolios, and Constrained Optimization

By: Isaac Soria, Rodrigo Flores, Rebecca Serrato, Kyle Wright, Cory McCullough

Effectively analyzing and selecting stocks for investment in the stock market is difficult for new investors. Given the use of previous stock market data, we seek to identify investment strategies that maximize profit while minimizing risk. We formulate this as a constrained optimization problem based on modern portfolio theory. We use clustering methods to group stocks based on their volatilities, variable risk tolerance, and previous overall performance. Then, representative stocks are selected from these clusters as candidates for potential investment. For various levels of risk, a constrained optimization method is implemented using these candidates to maximize profit for each level of risk. The execution of this constrained optimization problem was able to identify investment portfolios that outperformed most alternative portfolios at all levels of risk. This research hopes to provide inexperienced stockholders with routes of investments based on a personal risk versus return ratio.

Luis Fujarte
RESUME

A Simple Convolutional and Residual Neural Network for Super Resolution
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Margarito Avila
RESUME

Can the accuracy of Emotion Recognition in Conversations be increased using Neural Networks?
By: Margarito Avila, Valerie Z. Pulido, Paul Stratton, Cory McCullough*, Applied Mathematics, UC Merced; Kyle Wright*,

Multimodal machine learning techniques for emotional recognition in conversations (ERC) continue to improve with the explosion of archived videos on the internet. Recent advances in the field improve efficacy by utilizing visual recognition in conjunction with the established methods of audial analysis. This project improves on these established methods, improving the baseline accuracy for video recognition to build off of. This research derives emotion from the audio of conversations by employing long short-term memory models (LSTMs), a type of recursive neural network (RNN). The model trains using different sample rates and lengths as inputs in the form of Hertz per second. Preliminary results predict greater accuracy than previous models due to the focus on audio and the use of the Multimodal EmotionLines Dataset (MELD), a recent dataset that is more comprehensive and diverse for training ERC models. An improved ERC baseline may lead to an improved audiovisual ERC model. This improved ERC model has applications in chatbot effectiveness and user data collection, leading to better online user experiences and the accuracy of user datasets.

Paul Stratton
RESUME

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Rebecca Serrato
RESUME

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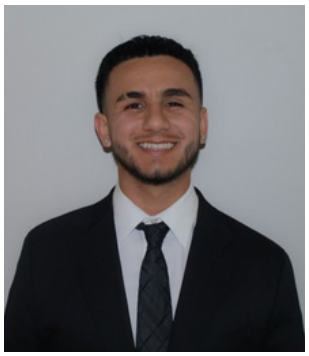

Rodrigo Flores
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Ronald Nap
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Ryan Milstrey
RESUME

A Simple Convolutional and Residual Neural Network for Super Resolution
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Valerie Zaira Pulido
RESUME

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SOAR

The following student scholars are participants in UC Merced's SOAR program. The Summer Opportunity for Advanced Research provides funding for UC Merced Undergraduates with prior research experience to continue their projects and research development at UC Merced. Qualified students with interest in pursuing graduate school are especially encouraged to apply. This program is funded directly through the Division of Undergraduate Education.

For more information, please visit
https://uroc.ucmerced.edu/soar

Alexis M. Galaz
SOAR

First generation college students' relationship with depression: Testing leisure time as a moderator.

By: Alexis M. Galaz, Anna-Celine Guilas, Matthew J. Zawadzki, PhD

First-generation college students suffer many social, physical, and mental health outcomes compared to their continuing-generation peers. Further, although we know that depression is prevalent among college students in general, depression and potential buffers to preventing depression, have not often been studied among first-generation students. In particular, first-generation students may not benefit from engaging in self-care like leisure time due to feeling imposter syndrome. Thus, we first tested if depression levels differed by student type, and if leisure time buffered that effect. Undergraduates who attended UC Merced (n=356) completed a survey online through Qualtrics. Participants were aged 18-57 (M=20.76,SD=3.55), with 281 women (80.1%) and 231 (65.3%) who identified as Hispanic. First generation was measured as having neither parent who completed a four-year degree. Participants also reported on their depression levels using a validated measure and reported how much time they spent on leisure in the last week. Testing our first research question, a one-way ANOVA revealed that first-generation students (M=0.98,SD=0.55) reported higher depression levels than continuing generation students (M=0.83,SD=0.47),F(1,329)=5.88,p=.016. Testing our second research question, using regression models in PROCESS, leisure was not a significant moderator (p=.576). This study indicates that first-generation students are vulnerable to experiencing depression and that more research is needed on factors that might reduce depression for these students.

Citlaly Ponce Torres
SOAR

Analysis of Red Blood Cell Development and Stress Erythropoiesis in Spleen and Bone Marrow of Mice Exposed to Glyphosate

By: Citlaly Ponce Torres, Jennifer O. Manilay, PhD

Roundup® is the most widely used herbicide for the maintenance of weeds and grasses. The current formulation of this herbicide contains glyphosate as the active ingredient. Many regulatory agencies have concluded Roundup® is not harmful to humans, however recent studies have shown negative effects to humans, non-human mammals, and fish. We hypothesize the exposure to glyphosate in mice will alter blood cell production and/or morphology as a result of changes in the bone marrow. To test our hypothesis, we are doing a complete blood count (CBC) analysis, which is a blood test that can be used to assess the overall health of mice by assessing the different properties of their blood, such as the number of red or white blood cells. This is a safe, nonlethal procedure that allows researchers to determine if there are any preliminary effects on the blood of mice after different treatments or genetic mutations. We are also doing flow cytometry to follow hematopoiesis. The initial results from our studies suggest that changes in the blood cell composition and morphology occur as a consequence of chemical exposures. Further studies at later time points are required to ascertain if these changes are permanent or transient. Altogether, these studies can aid in the standardization of glyphosate regulations among organizations.

Joshua Ancheta
SOAR

Atomic-Resolution Imaging of Mo2C Under Ambient Conditions
By: Joshua F. Ancheta, Gokay Adabasi, MS; Mehmet Z. Baykara, PhD
MXenes are an emerging class of materials that are composed of a transitional-metal paired with either carbon or nitrogen. This family of materials has great potential to be used in energy storage and electromagnetic interference shielding applications, as well as transparent conductors in electronic devices. For their effective implementation in all of these applications, a detailed understanding of their atomic structure and electronic properties needs to be formed. Conductive Atomic Force Microscope (C-AFM) is an advanced microscopy method that records the interaction forces as well as the electric current between a very sharp tip and a sample surface, with the capability of producing atomic-resolution images of surfaces. In this work, we will use C-AFM to study molybdenum carbide (Mo2C) surfaces, a representative MXene. In particular, we will focus on measuring atomic strain fields near defects and their influence on surface electronic properties.

Joshua Rotondo-Valentine
SOAR

Using the Object Spatial Imagery Questionnaire & Life Events Inventory to investigate personal imagery styles' relationship with memory
By: Joshua Rotondo-Valentine, Michael Spivey, and Benny Nguyen
Verging between two different camps that either support the classical cognitive approach or the embodied cognitive approach, there is much debate regarding the relationship between mental imagery and memory (Robin & De Bont, 2022). This continued debate is in spite of fMRI data revealing mental imagery underlies similar neurological activity of visual perception (Marre et al., 2021), and also being facilitatory in a variety of autobiographical memory processes (Vannucci et al., 2016). Here, we adopt a similar questionnaire-protocol to that of an imagination-inflation study originally conducted by Mazzoni & Memon (2003) and attempt to demonstrate that imagery and its relationship with memory can be conjointly revealed with administration of both the Life Events Inventory (LEI; Cochrane & Robertson, 1973) and the Object Spatial Imagery Questionnaire (OSIQ; Blajenkova et al., 2006).

Juan Estrada
SOAR

Evaluating the Effectiveness of FAA Drone Regulations for Operations Over People
By: Juan Estrada and Brandon Stark PhD

In 2021, the Federal Aviation Administration introduced new regulations to enable Operations Over People - this was a crucial next incremental step towards further integration of unmanned aircraft into the National Airspace System. These regulations classify aircraft into three separate categories, Category 1, Category 2, and Category 3 drones. Category 1 drones are restricted to a maximum weight of 250 g with propeller guards, while Category 2 and 3 drones are subject to performance-based eligibility and operating requirements when conducting operations over people. Despite the high demand for operations over people, in the 2 years since the regulations were implemented, only one drone has been certified as a Category 2 or Category 3. This has raised concerns about the applicability and usefulness of the regulations as implemented. In this study, we will explore the performance-based eligibility requirements of Category 2 certification and explore potential certification methodologies. By conducting these initial experiments, we hope to gather valuable insights into the behavior and impact of drones on objects and assess their compliance with the newly established safety thresholds. The findings from this study will contribute to a deeper understanding of the effectiveness and feasibility of the FAA's regulations regarding aerial operations over people.

Maylyn Ankary Torres
SOAR

Gateway to Merced: Queer Experience
By: Maylyn A. Torres, Jayson Beaster-Jones, PhD

The Gateway to Merced project focuses on shifting the narrative of what Merced is known for. Currently, it uses the phrase “Gateway to Yosemite” to market itself, taking away from what makes Merced a town that the community loves. This project is a collaborative effort to gather information from underrepresented groups in Merced County to showcase the value of Merced. This effort also aims to produce open-ended discussions with community members and to inspire others to embrace all aspects of Merced County. This study focuses on the history and experiences of the LGBTQIA+ community in Merced County through interviews with individuals who have seen and experienced what life is like in this county while being queer and what changes have occurred throughout the past few decades. These interviews are recorded through video and audio and are then transcribed and preserved as oral histories. These transcriptions are then analyzed to discover how the LGBTQIA+ community in Merced has faced discrimination and how it differs in comparison to larger cities. They are also analyzed to discover shared experiences considering the lack of a larger queer community presence in the county which has made being a part of the LGBTQIA+ community an individual experience. Conclusively, the results of this study creates a documentation of queer history in Merced while simultaneously contributing to uplifting the way that Merced is viewed.

Nyjah Robertson
SOAR

Amending Organization

By: Nigel Hatton

Mass incarceration of the Black community is the institutionalized reincarnation of Jim Crow-removing a large amount of Black people from society into a system intended to dehumanize the race. From state policies to institutional rules and regulations regarding these individuals' actions and interactions with the law and those who work under it, humane superiority is enforced through grouping people based on prototypicality stemming from racial, sexist, and capitalist intentions. I utilized the coding software ATLAS.ti to collect specific aspects of data from the literature to contain and review those segments in order to form an analysis. This material provided unguarded perspectives that aided my ideal world without prisons but instead an Amending Organization which will be an establishment of reformative practices for Law offenders that consists of preferred career camps, drug, and intrapersonal rehabilitation centers, and restorative justice laws and not criminal justice laws. Preferred career camps will provide offenders with a range of career exploration resources to reform their mindset and ability in work ethics, drug, and intrapersonal rehabilitation centers will serve as examined and sustained holistic reformative actions aside from substance abuses while restorative justice laws and not criminal justice laws will dissect the background of crime and disregard its proclaimed sentence because the time intended to be spent for these crimes in a cell is being carried out in the camps and centers to aid the rehabilitation of the offender intentionally. Further groundwork regarding this abstract will be investigated to execute this conception.

Shelly Anne Abu
SOAR

Gateway to Merced: Filipina/x/o American Community

By: Shelly Anne Abu, Jayson Beaster-Jones, PhD

As early as 1908, the city of Merced has been known as “Gateway to Yosemite", a term coined as the City’s tourism slogan. The phrase is still prominent on official signage around town. The Gateway to Merced project aims to shift the narrative of Merced’s reputation as being another rest stop or college town to instead acknowledging and celebrating Merced County’s inclusive history of underrepresented communities. This project is a community collaboration of collected oral histories that uplifts and preserves underrepresented groups. In this research, the focus is on gathering the history and lived experience of the Filipinx American Community in Merced County through guided interviews of audio and video recordings. Conducting these guided interviews aims to facilitate open-ended discussion with community members that will be transcribed. These transcriptions will be analyzed to examine the ways of how the community has experienced the complex process of assimilation, challenges faced in navigating cultural identity, and if presence of a university affects intergenerational dynamics. The study offers insights into looking at the diverse experiences and struggles that are faced by the community. With active community participation, the outcomes of this research will promote inclusivity, understanding, and cultural pride. Ultimately, this study’s results empower and preserve culturally significant stories in Merced County while contributing to a more positive and comprehensive understanding of the region's history.

Socheata Hour
SOAR

Analysis of Capacity Expansion Modeling for California

By: Socheata Hour, Sarah Kurtz, PhD

The conversion to zero carbon emissions requires a more robust and responsive electrical grid capable of using renewable energy to meet electricity demand reliably. The objective is to characterize the impacts of different conditions on the future of California's technology viability and distribution. Modeling the power grid requires estimating the costs to build and operate the various electrical grid components. In this study, we leverage the work of Energy + Environmental Economics (E3), a consulting company. They developed software, RESOLVE, an electricity resource planning model to help find optimal investments subject to reliability, policy, and technical constraints. RESOLVE identifies available technologies that provide a low-cost and reliable grid with zero emissions associated with retail sales of electricity. Understanding the modeling results requires visualizing the data in multiple ways. In particular, we will focus on the use of long-duration storage resources, which are anticipated to become increasingly important as the grid uses more renewable energy resources like solar and wind. Our goal is to develop and automate graphing strategies that enhance our understanding of the model's utilization of long-duration energy storage. This will enable us to compare various scenarios and effectively communicate the future of renewable energy in California.

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. This program is directly supported by the Division of Undergraduate Education.

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

Agustin Molina
SURF SSHA

Math Chronicles: Instructors' Implementation of Calculus Teaching Practices
By: Joshua J. Rosario, Agustin Molina, Sarah Frey, PhD; Linda Sheehan, EdD

Performance in Calculus courses is seen as a major barrier to STEM students' progression in higher education institutions (HEIs), particularly for underrepresented minorities (URMs) and first-generation college students (FGC). This study used a sequential explanatory mixed methods design split into two phases to examine the relationships between undergraduate calculus instructors' teaching practices, classroom implementation, and the impact on their students' grades. Phase one utilizes Wieman and Gilbert's (2014) Teaching Practice Inventory (TPI), a validated reflective self-reporting tool of teaching practices used in undergraduate mathematics courses. Sixteen instructors teaching Calculus 1 or II were invited to take the TPI. Descriptive statistics, multiple regression analysis, and comparison of means were assessed with the Statistical Product and Service (SPSS) software program. Phase two utilizes semi-structured interviews through Zoom to explore how the instructor applied teaching practices to shape their student's performance. Data analysis follows the constant comparative method utilizing microanalysis, open coding, and axial coding. Results will show whether there is a significant correlation between instructors' TPI scores and their student's grades ($\alpha = 0.05$). Results also reveal themes related to the instructors' training, teaching practices implementation, and any anticipated barriers. Findings contribute to the literature of research-based instructional strategies in mathematics and the understanding of critical factors that support student success, especially for URMs and FGC students.

Annette Ruiz-Arreola
SURF SSHA

Parental Occupational Prestige and Neural Indices of Cognitive Control
By: Annette Ruiz-Arreola, Nancy Rodas De León, Elif Isbell, PhD

Lower parental income has been linked to poorer cognitive control in childhood. However, whether this link persists into adulthood is unclear. One of the challenges in studying childhood family income is that we can not collect accurate retrospective reports of parental income. To address this, parental occupational prestige can be used as a proxy for parental income. The aim of this study is to examine the links between parent occupational prestige in childhood and neural indices of cognitive control in adults. Participants were adults between the ages of 18-30 (N=68). We asked participants what their parents' occupations were when they were 10 years old and coded the prestige of these occupations according to a newly developed index. To measure a neural marker of cognitive control, we recorded event-related potentials (ERPs) during a visual oddball task in which participants were instructed to press a button for a non-target letter and press a different button for a target letter (20%). The neural indices of cognitive control were the magnitude and latency of the P3 ERP component. Data collection is completed, and data analyses are in progress. Results will be presented at the UROC symposium. Our results may contribute to a more comprehensive understanding of the links between different aspects of childhood socioeconomic conditions and neurodevelopment of cognitive control from childhood through adulthood.

Deija Moore
SURF SSHA

Impact of the Public Health Pathways Living Learning Community on Sense of Belonging in First-Year College Students

By: Deija L. Moore, Lindsay K. Crawford, PhD

The purpose of living-learning communities (LLC) is to increase retention, involvement, academic outcomes, and a sense of belonging in college students. While a sense of belonging is credited as having a major impact on the success of LLCs, there is limited research on college students' sense of belonging (SB) and its association with LLCs. There are several LLCs at the University of California-Merced, including the Public Health Pathways LLC. The current study aims to identify in the literature and find the best practices to cultivate SB in first-year students at UC Merced. We have hypothesized that being a part of the LLC will improve the Sense of Belonging among the students enrolled, which will lead to a smoother transition to college in their first semester. A cohort of thirty students from the Public Health Pathway LLC will be compared to a control group; consisting of thirty non-LLC students. Both groups will be observed as they participate in weekly seminars, surveys, focus groups, and various social and academic events designed to aid their development. Sense of Belonging will be collected using the General Belongingness scale (GBS; Malone et. al., 2012).

Destiny M. Marquez
SURF SSHA

Impact of Living Learning Communities on Sense of Belonging in First-Year College Students

By: Destiny M. Marquez, Lindsay Crawford, PhD

University of California, Merced (UCM) has a large population of first-generation students, many of which have difficulties adapting to their new environment. Being the first in their family to attend a four-year university, these students may struggle to find resources, adapt to rigorous course schedules, and be actively involved on campus. Living Learning Communities (LLC) have been shown to aid undergraduate students with the social and academic transition in that first year. However, there is limited research on students' Sense of Belonging (SB) and how it is impacted by LLCs. The current study aims to close this gap in the literature and find the best practices to cultivate SB in first year students at UCM. Our hypothesis is that the LLC will improve SB among the students enrolled, which will lead to a smoother transition to college in their first semester. A cohort of 30 students will be recruited into the LLC and observed as they take part in weekly seminars, focus groups, and various social and academic events designed to aid their development. They will be compared to a control group of 30 non-LLC students. Data will be collected using the General Belongingness Scale (GBS; Malone et al. 2012), and results will be compared throughout their time at UCM.

Dylan Jong
SURF SSHA

Testing the Moderating Effect of Mental Stability on the Relationship between Anxiety and Cynical Work Performance

By: Dylan Jong, Zoltan Torok, PhD, & Matthew Zawadzki, PhD

Feeling like one's work is undervalued – cynical work performance – can lead to poor health outcomes. Research has examined the impact of mental illness on work performance, yet little has examined anxiety as a factor despite its prevalence in the workplace. Further, less understood is how mental stability may buffer the impact of anxiety. Therefore the present study investigated whether individuals with higher levels of anxiety would have more cynical work performance (RQ1), and whether this would be exaggerated for those with lower levels of mental stability (RQ2). Non-faculty employees (n = 140) from the University of California, Merced participated in the study by completing online surveys, including the Generalized Anxiety Disorder scale, the Bergen Burnout Inventory with cynical work performance measurement, and the SF-12 Health Survey to measure mental stability. Testing RQ1, a bivariate correlation revealed a small correlation where more anxiety related to more cynical work performance, $r = 0.245$, $p = 0.003$. Testing RQ2, regression models using PROCESS found a significant interaction, $b = 0.01$, $SE = 0.01$, $p = 0.012$, such that cynical work performance decreased as one had more stability for low and moderate anxiety participants, but remained high regardless of stability for those highest on anxiety. Results suggest the importance of mental health on how one performs at work, providing insight into possible interventions to promote healthier work environments.

Gillian Morgan
SURF SSHA

Incorporating the Work of W.E.B. Du Bois to Address Underrepresentation of Racial and Ethnic Minority Students in STEM Education

By: Gillian L. Morgan, Whitney Pirtle PhD.

Underrepresented racial and ethnic minority (URM) students, including Black, Latinx, and Indigenous students, face significant challenges in pursuing advanced study and professions in science, technology, engineering, and mathematics (STEM), including data science. This research aims to address underrepresentation by incorporating the work of prominent Black social scientist W.E.B. Du Bois into the statistics and data science components of STEM and STEM-related curricula. Research questions proposed in this study are: (1) What proportion of assigned readings in STEM courses at the University of California, Merced (UCM) are from scholars of color? (2) Which specific readings, including those by W.E.B. Du Bois, are assigned in these courses? To answer these questions, an extensive data collection effort was conducted by gathering syllabi from all research methods courses offered at the University of California, Merced. By examining the collected data, this research seeks to determine whether research methods courses at UCM incorporate the teachings of W.E.B. Du Bois or any other scientist of color. Expected results will shed light on the extent to which scholars of color are represented in the curriculum and whether there is a need for increased diversity in assigned readings in STEM courses. Research findings will benefit STEM courses globally by providing insight and recommendations for curriculum enhancement that will benefit both URM students and the broader STEM community.

Iliana Romero
SURF SSHA

Examining the Interplay between the Chicano Movement and Hispanic Americans': Educational Attainment, College Enrollment, and Occupational Segregation
By: Iliana N. Romero, Sayra Lucas, and Todd Sorensen, PhD

The Chicano Civil Rights Movement emerged from the discriminatory treatment and marginalized experiences Mexican Americans faced in the United States. The movement inspired students in East Los Angeles to initiate a series of protests to change the educational system within schools. Instead of preparing Mexican Americans academically for college, educational institutions would steer students towards domestic training and vocational occupations. The research analyses the possible correlation between the movement and the increase in college enrollment in Los Angeles and tests to see if this alteration further led to changes in the Hispanic-American labor market. Using data collected by the United States Census, we examined the evolution of education levels and occupations over time. Our results indicate an improvement in education levels and college enrollment. Specifically, the number of years of education pursued by Hispanic Americans has increased from 9 years in 1960 to 11 years in 1980. Furthermore, the college enrollment rate in Hispanic-American communities increased from approximately 11% in 1960 to 20% in 1980. As for occupational segregation, our data shows a constant decrease in segregation within the workforce. In light of these observations, the data provides insight into how social movements like the Chicano movement, to a degree, can result in positive outcomes for communities and individuals' rights.

Ilse Flores
SURF SSHA

What characteristics predict a likelihood in engaging in misinformation?
By: Ilse E. Flores, Elaine Denny, PhD.

Social media has enabled the spread of fake news which has been provided by unreliable sources who spread misleading information and rumors faster without any verification. Misinformation has been created by social media users who spread fake news across the internet in order to gain interaction with the public. Research shows that misinformation in social media spreads faster, farther, and deeper than true stories. By exposing that information to the public, individuals who believe this information will most likely share it and spread the information. In many cases, misinformation is designed to target specific audiences either for financial or political purposes. This study utilizes nationally represented data to find the types of people who show online behaviors that make them vulnerable to misinformation. Additionally, the following study focuses on finding the characteristics of that specific type of behavior (e.g., depression, anxiety, linguistic features, sentiment features, user behavioral features). Lastly, the study also aims to find which demographics (e.g., race, age, social economic status) are more vulnerable to accept misinformation. We expect to find people with higher education, such as college students, are most likely to pay attention to details as they have shown higher levels of consciousness. In addition, college students will be most likely to fact check and review stories in order to slow down the spread of misinformation. Some of the behavioral features included in the research study includes discussion initiation, interaction engagement, informational independence and relation with the information provided.

Isabel Robles
SURF SSHA

Finding the link between Rumination and Depression: Exploring First Generation Status as a Moderator

By: Isabel M. Robles, Anna-Celine Guilas, Matthew J. Zawadzki, PhD

Rumination is a maladaptive cognitive process characterized by repetitive and self-focused thoughts, which has been extensively studied in relation to depression. However, limited research has explored whether demographic factors like first-generation student status might moderate this relationship. First-generation students are prone to experiencing imposter syndrome and lack of belonging, and thus rumination that might accompany those experiences may be more strongly related to depression than continuing-generation students who tend to have less tense experiences like these. Therefore, this research aims to explore the relationship between rumination and depression. We predict that those who have a constant amount of negative thinking will have increased chances of having symptoms of depression, and that those who are first-generation students will show a higher associative relationship between rumination and depression. To test these hypotheses, undergraduate students (n =400) from UC Merced completed an online survey using Qualtrics. Their average age was 20, with 256 reporting they were first-generation college students. Testing the first research question, using a bivariate correlation revealed that as rumination increases so did depression symptoms, $r=.60$, $p<.001$. Testing the second research question, using regression models in PROCESS, first-generation status did not moderate associations between rumination and depression ($p=.144$). Overall results show the consequences of engaging in negative thinking and suggest a potential target for intervention to reduce depression. Further, lack of moderation highlights that this impact rumination

Israel Castillo
SURF SSHA

A Review on the Impact of Stress on Collegiate Athletes': The Susceptibility to the Spread and Consumption of (Mis)information and Initial Survey Design

By: Israel A. Castillo, Elaine K. Denny, PhD;

Collegiate student-athletes who engage in an intercollegiate sport may endure more stress as they try to balance being a student and an athlete. Collegiate student-athletes must fulfill their obligation to academic workload and athletic competition, in which they must find the balance to attend practice, maintain a minimum grade-point average to remain eligible, practice and train when not attending classes, and represent their school respectfully. Thus, I will discuss how stress impacts collegiate student athletes and how (mis)information is presented within the athletic community. (Mis)information is false or inaccurate information that is deliberately created and is (un)intentionally propagated. Then using a survey experiment, I will randomize exposure to stress and test how increased stress will increase the susceptibility to the spread and consumption of (mis)information. I will measure stress levels directly through electrodermal activity as well as self-reported psychological states. Outcomes of interest include a) fact-checking, b) sharing, and c) belief in mixed-truth sports stories circulating online. This work is presented as a Registered Report, with focus on study design before data collection begins.

Jasmine Camacho
SURF SSHA

Connectedness and Coordination: Unraveling the Dynamics of Social Event Planning among College Students using Online Messaging Systems

By: Jasmine L. Camacho, Paul P. Maglio, PhD

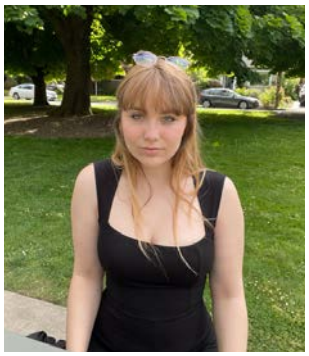
This research study explores the ways college students plan social events and activities using online messaging systems. Prior research has shown that connecting with others increases well-being and according to Epley et al. (2022), undersociality resulting from miscalibrated social cognition can hinder social connection. Using qualitative interviews and analysis, we examined the challenges of planning events and activities, focusing on when planning results in actual real-life events and activities and when it does not. Through extensive data analysis and in-depth interviews with current college students in California, it was identified that the effectiveness of college students' social event planning using online messaging systems is influenced by the level of perceived social connectedness and the degree of coordination and collaboration among participants during the planning process. Our study focuses on key factors in this social planning process, including awareness, initiation, and execution. The findings of this research will contribute to the development of tools and technologies aimed at helping people plan social events effectively and efficiently. The long-term goal is to alleviate some loneliness by helping people more easily add to the webbing of their social fabric.

Joshua J Rosario
SURF SSHA

Math Chronicles: Instructors' Implementation of Calculus Teaching Practices

By: Joshua J. Rosario, Agustin Molina, Sarah Frey, PhD, Linda Sheehan, EdD

Performance in Calculus courses is seen as a major barrier to STEM students' progression in higher education institutions (HEIs), particularly for underrepresented minorities (URMs) and first-generation college students (FGC). This study used a sequential explanatory mixed methods design split into two phases to examine the relationships between undergraduate calculus instructors' teaching practices, classroom implementation, and the impact on their students' grades. Phase one utilizes Wieman and Gilbert's (2014) Teaching Practice Inventory (TPI), a validated reflective self-reporting tool of teaching practices used in undergraduate mathematics courses. Sixteen instructors teaching Calculus 1 or II were invited to take the TPI. Descriptive statistics, multiple regression analysis, and comparison of means were assessed with the Statistical Product and Service (SPSS) software program. Phase two utilizes semi-structured interviews through Zoom to explore how the instructor applied teaching practices to shape their students' performance. Data analysis follows the constant comparative method utilizing microanalysis, open coding, and axial coding. Results will show whether there is a significant correlation between instructors' TPI scores and their students' grades ($\alpha = 0.05$). Results also reveal themes related to the instructors' training, teaching practices implementation, and any anticipated barriers. Findings contribute to the literature of research-based instructional strategies in mathematics and the understanding of critical factors that support student success, especially for URMs and FGC students.



Kaitlynn Totter
SURF SSHA

Connectedness and Coordination: Unraveling the Dynamics of Social Event Planning among College Students using Online Messaging Systems

By: Kaitlynn Totter, Soran Malaie, Michael Spivey, PhD, and Jeff Yoshimi. PhD

Embodied cognition suggests that our cognitive processes are intertwined with our bodily experiences and the physical environment. Previous research revealed that navigating a spatial map to find divergently-placed goals enhanced divergent thinking, while navigating towards a single goal on the same map enhanced convergent thinking. The study aims to address methodological concerns associated with these findings and examine their generalizability by using a more realistic maze map and introducing a true converging condition in the convergent prime task. We predict that in divergent thinking tasks, participants engaged in spatial searches with multiple goals will outperform participants in spatial searches with a single convergent goal. Conversely, in convergent thinking tasks we predict those engaged in searches with a single converging goal will outperform those with multiple goals. These findings support the notion that sensorimotor processes, like spatial search, are repurposed in higher-level cognitive processes such as creativity. By exploring the connection between creativity and spatial-goal searches, this research enhances our understanding of the relationship between physical spatial searches and abstract cognitive processes. It sheds light on the evolutionary origins of human creativity and provides insights into how our cognitive abilities are influenced by our bodily experiences and the environment. Overall, this study contributes to the field of embodied cognition and deepens our comprehension of the mechanisms underlying creativity in the context of spatial-goal searches.

Kanchana Khat
SURF SSHA

State Responses to Covid: Cataloguing Changes to Experience Rating

By: Kanchana Khat, Andrew Johnston Ph.D.

In the face of massive layoffs during the early days of covid, several states decided to suspend experience rating, the practice by which states penalize firms for layoffs with higher payroll taxes. In this study, I do independent research to catalog which states suspended experience ratings, when they announced the suspension, and when, if at all, each state resumed the practice of experience rating. I find that about half of states suspended experience ratings and that the practice was not correlated with a state's partisan leaning or covid death rate. The data collection effort paves the way for future analyses on the effect of experience rating on workers and the labor market.

Karla Ramirez
SURF SSHA

Exploring the Interplay between COVID-19 and Employment in California: Unraveling the Next Steps if it Reoccur

By: Karla G. Ramirez, Justin J. Hicks, PhD

This research delves into the relationship between the COVID-19 pandemic and employment rates by county in California, with a focus on understanding which policies worked and which did not. The rapid spread of COVID-19 led to widespread business closures, resulting in a rapid escalation of unemployment rates. As COVID-19 positivity rates escalated, different counties responded differently, in closure policies and enforcement of local and state mandates. Consequently, this study examines the relationship between COVID-19 positivity rates, the deaths that came from the disease, and their influence on employment and unemployment rates. Further, I investigate the ramifications of political affiliation by leadership and voters on employment and COVID-19 positivity rates and mortality rates. This study hopes to shed light on several factors in each county that led to differences in the effects of the COVID-19 pandemic. Using quantitative research, this study combines data from local, state, and federal sources to best identify causal effects. This research's intention is to understand more thoroughly what worked well, and what did not with hopes to make future policy decisions more effective in helping residents in California and elsewhere.

Kate Larios
SURF SSHA

Testing the Interactive Effect of Physical Activity and Sleep Quality on Anxiety

By: Kate Larios, Zoltan Torok, PhD, & Matthew Zawadzki, PhD

Being physically active has been shown to reduce anxiety, and interventions have been designed around increasing activity levels to improve mental health. At the same time, research has found that sleep quality also relates to reduced anxiety. Yet, the potential combined effect of physical activity and sleep quality has rarely been explored. We predict that those with more total steps per day will have decreased anxiety, and that better sleep quality will moderate this effect. Data was collected from 143 UC Merced employees, aged 21-65 ($M = 38.24$), with 73.4% women and 95.1% Non-Hispanic-identifying participants. Physical activity was measured by average steps per day collected by Fitbits over the span of four days. Sleep quality was measured by self-report over four consecutive days each morning when participants woke up. Anxiety was measured up to four times a day for four days using Ecological Momentary Assessments. Testing RQ1, a bivariate correlation revealed a small negative correlation where more steps per day were related to less anxiety, $r = -0.227$, $p = 0.008$. Testing RQ2, regression models using PROCESS found a significant interaction, $b = 0.0001$, $SE < 0.0001$, $p = 0.045$, such that anxiety levels decreased as one had better sleep for low and moderate activity participants, but were lowest for those with the highest physical activity levels regardless of their sleep quality. Results indicate the importance of both physical activity and sleep quality in relation to anxiety and suggest the need to consider both in future intervention

Luisa Rincon
SURF SSHA

The Impact Acculturative Family Distancing has on the Parent- Youth Relationship
By: Luisa G. Rincon Gramajo, Elisa Gomez, M.Ed. Mayra Bamaca, Ph.D.

The parent child relationship is an influential aspect in Latinx families. It can guide how values, traditions, and cultures are passed down from one generation to another (Padilla et al., 2020). Therefore, it is important to understand the factors that can shape the relationship between parents and their children. The current study looks at the impact of three parent child relational domains-supportive parenting, cultural and family values incongruence on family obligation adherence. Family obligation is defined as caring for siblings, assisting family with tasks, or financially supporting family members (Tsai et al., 2015). These domains were collected through an online survey taken by college students that identified as Latinx. We hypothesized that supportive parenting would positively predict family obligation values and both cultural and family values incongruence would negatively predict family obligation values. Two sets of regressions were ran to capture the relationship with mothers and fathers independently. For both mothers and fathers all three relationship domains significantly predicted family obligations. When all three relationship domains were ran together only family values incongruence predicted family obligations. Thus, this study aims to fill in the gap of acculturation by understanding the impact of AFD, which has not been sufficiently studied among the Latinx population.

Marcela Cardoza Cortez
SURF SSHA

A Correlational Study of Emotion Brokering Frequency and Maternal Relationship Quality Among Latinx College Students
By: Marcela A. Cardoza Cortez, Sivenesi Subramoney, MA, & Eric Walle, PhD

Prior research on language brokering investigated the relationship between language brokering frequency and familial relationships (Shen et al., 2022). While language brokering frequency is associated with more conflict within parent-child relationships, frequency doesn't necessarily hinder the supportive qualities of these relationships (Hua & Costigan, 2012). Prior research has not investigated how this applies to emotion brokering (EB), a process where the interpretation of emotions takes place as a result of cultural differences in emotions which produces communication gaps between members of different cultures. This study examined the relationship between emotion brokering (EB) frequency and maternal relationship quality among Latinx college students. Participants reported EB frequency for their mothers and the quality of that relationship using conflict and support items from The Network of Relationship Questionnaire (NRI-SPV; Furman & Buhrmester, 1985). We hypothesized that EB frequency may be associated with conflict but not with support. Participants that reported more brokering frequency were more likely to experience conflict in their maternal relationships ($r = .164$, $p = .079$) while EB frequency was not associated with support ($r = .057$, $p = .543$). This is an important area of study to focus on as it can help better understand the various characteristics of Latinx familial relationship dynamics and the roles and responsibilities that child brokers have.

Melisa R Lovos Palacios
SURF SSHA

Is there a link between the degree of bilingualism and cognitive control?
By: Melisa R Lovos Palacios, Nancy Rodas De León, Elif Isbell, Ph.D.

Bilingual individuals' languages are jointly activated even when only one language is being used. It has been argued that as bilinguals switch languages effectively, disengaging from one language and activating the new one, they develop enhanced cognitive control skills. However, a "bilingual advantage" of cognitive control skills has not been well replicated. Some researchers have argued that the contradictory findings are related to the dichotomization of measuring bilingualism. To address this issue, the present study aims to assess bilingualism as a continuous variable. We expect that the degree of bilingualism will be related to neural and behavioral indices of cognitive control among bilingual individuals. To test this hypothesis, we collected neural and behavioral data from 18-to-30 years old adults with diverse language experiences using the Active Visual Oddball task from ERP CORE (Kappenman et al., 2021). The neural index of cognitive control was the magnitude of the P3 ERP component, and the behavioral index was the accuracy of responses. An adaptation of the Language Social Background Questionnaire (Anderson et al., 2018) was used to measure the degree of bilingualism. The data collection is completed, and analyses are in progress. The findings of this study will contribute to our understanding of cognitive control in young adults with diverse language experiences.

Sayra Lucas
SURF SSHA

Examining the Interplay between the Chicano Movement and Hispanic Americans': Educational Attainment, College Enrollment, and Occupational Segregation
By: Sayra Lucas, Iliana N. Romero, and Todd Sorensen, PhD

The Chicano Civil Rights Movement emerged from the discriminatory treatment and marginalized experiences Mexican Americans faced in the United States. The movement inspired students in East Los Angeles to initiate a series of protests to change the educational system within schools. Instead of preparing Mexican Americans academically for college, educational institutions would steer students towards domestic training and vocational occupations. The research analyses the possible correlation between the movement and the increase in college enrollment in Los Angeles and tests to see if this alteration further led to changes in the Hispanic-American labor market. Using data collected by the United States Census, we examined the evolution of education levels and occupations over time. Our results indicate an improvement in education levels and college enrollment. Specifically, the number of years of education pursued by Hispanic Americans has increased from 9 years in 1960 to 11 years in 1980. Furthermore, the college enrollment rate in Hispanic-American communities increased from approximately 11% in 1960 to 20% in 1980. As for occupational segregation, our data shows a constant decrease in segregation within the workforce. In light of these observations, the data provides insight into how social movements like the Chicano movement, to a degree, can result in positive outcomes for communities and individuals' rights.

Vania Huaranga
SURF SSHA

Adult ADHD Symptoms and Neural Indices of Cognitive Control

By: Vania Huaranga, Nancy Rodas De León, Elif Isbell, Ph.D

Cognitive control allows us to pursue goals, especially in the face of distractions. Attention-deficit/hyperactivity disorder (ADHD) has been linked to cognitive control problems (Barkley, 1997). Although ADHD symptoms commonly onset in childhood, 40–50% of individuals with ADHD may meet criteria as adults (Sibley et al., 2016). However, it is poorly understood how the brain functions supporting cognitive control may be altered in adult ADHD. To address this gap, the present study aims to investigate the links between adult ADHD symptoms and a neural marker of cognitive control, the P3 ERP component. We expect to see differences in neural indices of cognitive control between participants with lower and higher symptoms of ADHD. Electroencephalography (EEG) data were collected from participants ages 18-30 (N=68; Mean age=22.34; 51.39% female). Participants performed a visual oddball task in which they were instructed to respond with one button for their target (20% of trials) and another button for non-target letters. ADHD symptoms were measured with a clinical screening questionnaire (ASRS-v1.1). Data collection and processing are completed, and data analyses are in progress. Results will be presented at the UROC Symposium. Our findings will contribute to the understanding of neural mechanisms of adult ADHD.

Yu Fang Tseng
SURF SSHA

Links Between Auditory Preattentive Change Detection and Adult ADHD

By: Yu Fang Tseng, Dylan M. Richardson, Elif Isbell, Ph.D

Attention-Deficit/Hyperactivity Disorder (ADHD) is characterized by long-term symptoms of inattention and/ or hyperactivity-impulsivity interfering with daily functioning and quality of life. Although ADHD is mostly linked to altered neurodevelopment of self-regulation skills in childhood, previous research also showed that auditory processing may be altered in children with ADHD as well, even in the absence of any self-regulation demands (Cheng et al., 2016). However, it remains to be investigated whether adult ADHD symptoms are associated with altered auditory processing. In the current study, we aim to address this gap by investigating the links between ADHD symptoms in adulthood and the mismatch negativity (MMN), which is an event-related potential (ERP) component indexing preattentive auditory change detection. Compared to adults without probable ADHD, we expect to see a reduced amplitude in the MMN of adults with probable ADHD, due to altered preattentive change detection. ERP data were collected from participants ages 18–30 (N=68) while they completed a passive auditory oddball task, watching a video while ignoring sounds played in the background (80% frequent, 20% rare). ADHD symptoms were measured with a clinical screening questionnaire (ASRS-v1.1) and clinical screening cutoffs were used to assign adults to probable ADHD versus not probable ADHD group. Our findings will contribute to the understanding of the neural mechanisms of adult ADHD.

Amy White
SURF STEM

Population Fluctuations of Neostapfia colusana and Orcuttia inaequalis Grasses in Response to Precipitation Variations in Merced County's Vernal Pool Reserve

By: Amy White, Daniel Toews, Joy Baccei, Adam Malish, Anna VanZuuk, Jason Sexton

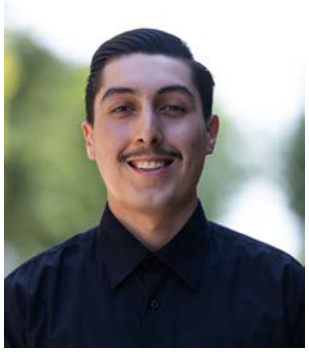
This study investigates the relationship between two rare plant species, Neostapfia colusana (NECO) and Orcuttia inaequalis (ORIN), and precipitation patterns throughout the history of Merced County's vernal pool reserve. We collected current and historical data on NECO and ORIN grasses from the vernal pool data bank, and data on precipitation and temperature. While the precipitation data for the University of California, Merced's weather station goes back to 2017 and the grass population data goes back to 2015, we supplemented the precipitation data with other weather stations in Merced. Our expected results indicate a correlation between NECO and ORIN and precipitation, with a solid correlation between NECO and ORIN. Previous years have shown a decline in the population of these species. However, the winter of 2022 witnessed an increase in population, attributed to the amount of precipitation collected. Notably, this area lacks population data from past years have shown some population growth in years, making this observation particularly significant. Although the observed impact is relatively small, the results demonstrate that precipitation does influence the population of NECO and ORIN grasses to some extent. This is important because the NECO and ORIN grasses population increases with more rainfall in the following years there is a likely chance that the NECO and ORIN populations can recover.

Cindy Torres Camacho
SURF STEM

Investigating effects of climate change and wildlife history on the runoff in the upper Merced River Basin

By: Cindy Torres Camacho, Safeeq Khan, PhD

Climate change is a key catalyst for environmental shifts, exerting profound effects on ecosystems and natural resources worldwide. Within Yosemite National Park, a renowned destination celebrated for its breathtaking scenery and diverse wildlife, the implications of climate change on water resources and conservation have become increasingly apparent. As temperatures rise, precipitation patterns alter, and wildfires become more frequent and intense, comprehending the transformations that climate change instigates in water conservation within Yosemite assumes critical importance. In this research, I will be investigating changes in climate and streamflow for the Merced River Watershed, a critical source of water for the valley and users downstream. Selected metrics include minimum, maximum, and average annual temperatures, seasonal, and annual precipitation and runoff data, center of flow timing. Initial results indicate an enhanced warming in the upper Merced River watershed since 1980s. However, finding similar trends between the annual precipitation and runoff data would require further investigation. To show a relationship between the increasing temperatures and the amount of discharge, there must also be a decrease in the center timing of flow, meaning that the snow is melting at a faster rate. This understanding is vital for implementing effective management strategies and safeguarding the future of this iconic natural haven.



Isaias Teran
SURF STEM

Copper Mini-Channel Solar Water Heaters and Their Potential for Producing Low-Grade Steam

By: Isaias A. Teran, Sourov Kumar Mondal, Edbertho Leal-Quiros, PhD, Gerardo Diaz, PhD

In 2021, conventional water heating systems in United States homes were responsible for approximately 520 million metric tons of carbon emissions. Currently available renewable alternatives, such as flat plate water heaters and evacuated tube water heaters, suffer from either low thermal efficiency or high manufacturing costs. In response to these limitations, a proposed solution involves the utilization of mini-channels that provide increased surface area, reduced heat loss, and improved heat transfer. Copper was selected as the preferred material for the mini-channels due to its superior thermal stability compared to Aluminum, which has a significant reduction in yield strength at high temperatures. By employing highly conductive copper mini-channels, this research aims to investigate potential improvements in steam generation. The novelty of the design relates to the production of low-grade steam from a solar collector without concentration and without using vacuum tubes. The ultimate objective is to integrate an orifice plate and copper mini-channels to achieve 100°C steam, demonstrating the superior performance of mini-channel solar water heaters over existing options. As such, by reducing reliance on natural gas and electricity, the approach aims to minimize greenhouse gas emissions and harness renewable energy through solar thermal applications.

Jackie Badillo
SURF STEM

Seagrass Microbiome: The Search for Marine Growth Promoting Rhizobacteria

By: Jackie Badillo, Diane Brache-Smith, E. Maggie Sogin, PhD

Zostera Marina, commonly known as eelgrass, is a type of seagrass that is present in many marine ecosystems. Globally, seagrasses perform a vital role in marine carbon sequestration and are estimated to be responsible for 10% of annual carbon storage in the oceans. Little information is available on the relationship between Z. Marina and the bacterial community that inhabits the rhizosphere of the plant. This project aimed to investigate this relationship by (1) isolating and characterizing the bacterial community of the rhizosphere, and (2) quantifying plant growth-promoting traits in the bacterial community. The purpose of characterizing the bacterial community and its plant growth-promoting traits is to create real-world applications, such as a synthetic bacterial community for the purpose of seagrass restoration efforts. To investigate the first aim, we isolated bacteria from the seagrass rhizosphere and identified each isolate by sequencing the full-length 16S rRNA gene. After identifying the bacterial symbiont, the ability of the symbiont to produce IAA, a hormone that plays a fundamental role in the promotion of plant growth, was assayed. Findings from this project help illuminate the complexity of the relationship between Zostera Marina and bacteria in the rhizosphere.

Jenifer Hernandez
SURF STEM

Effects of Exogenous Thyroxine on Cardiac Thioredoxin Antioxidant Defense Obese Insulin Resistant OLETF Rats

By: Jenifer Hernandez Garcia, Dora A. Mendez, Rudy M. Ortiz

Thioredoxin is a protein that regulates cellular signaling and antioxidant defense. Thioredoxin is essential for cellular antioxidant mechanism in the heart. Cellular antioxidant mechanism is designed to protect cells from oxidative damage caused by reactive oxygen species (ROS) and other free radicals. Oxidative damage can lead to cellular damage and impaired function. Diabetic cardiomyopathy (CDM) is a significant complication observed in many individuals with diabetes. Altered fuel metabolism is a key feature of CDM with diabetic hearts that exhibit an imbalance in fatty acids and glucose utilization, favoring fatty acid overutilization. Excessive fatty acid beta-oxidation in the mitochondria leads to generation of free radicals including superoxide, which can contribute to oxidative stress. Thyroid hormone may modulate glucose or fatty acids, which may alter Thyroxine. Therefore, we hypothesize that Thioredoxin will help regulate the oxidative stress by acting like an antioxidant and help reduce cardiac oxidative injury in insulin resistance rats treated with thyroxine. Insulin resistant, Otsuka Long Evans Tokushima Fatty (OLETF) rats were used to assess the effects of exogenous thyroxine (T4) on glucose metabolism in cardiac tissue. Rats were assigned to four groups: 1) lean, Long Evans Tokushima Otsuka (LETO; n=6), 2) LETO + T4 (8 µg/100g BM/d × 5 wks; n=7), 3) untreated OLETF (n=6), and 4) OLETF + T4 (n=7). Analyses are ongoing. This research will provide insight on potential treatments targeting patients with diabetic cardiomyopathy.

Kanghong Li
SURF STEM

Using Python codes to Visualize Giant Molecular Clouds and Open Star Clusters within them

By: Kanghong Li, Sarah R. Loebman, PhD,

Massive clouds containing hydrogen and other gasses, also known as giant molecular clouds (GMC), are the perfect location for the formation of open star clusters, where most new stars are born. Studying the evolution and stages of GMCs helped contribute to the knowledge of the relationship between GMCs and open star clusters. This task was accomplished by generating visualization code to visualize individual GMC and the open star clusters that form inside of them. The python code we developed was run on existing FIRE-2 (feedback in realistic environments) galaxy simulations and drawn from the Latte suite of Milky Way-like galaxies. We generated the code so we could extract and visualize individual GMCs and open clusters taken from the larger galaxy simulation. We ran this code over different moments in time so we could see how the star clusters impacted the GMCs evolution. We plan to publicly release this visualization code, so other simulators from the astrophysics community can use and add on to it.

Melvin Sanchez
SURF STEM

Chemical characterization of a coaxial dielectric barrier discharge for dry reforming applications

By: Melvin E Sanchez, Edgar Perez Lopez, Venkattraman Ayyaswamy, Ph.D.

In the past decade, extensive research has focused on the application of cold plasma discharge-type devices in diverse fields such as water remediation, soil remediation, surface modification, medical treatments, and dry gas reforming. These devices operate by utilizing a dielectric barrier discharge (DBD) configuration, where the discharge occurs between two electrodes separated by one or multiple dielectric barriers, such as glass, quartz, or ceramic. The DBD reactor is driven by an AC (alternating current) power supply, delivering high voltage and low current. The plasma chemistry within the DBD reactor is characterized by utilizing Optical Emission Spectroscopy (OES). OES captures spectra in the UV-Visible wavelength range, providing valuable insights into the composition of species present in the plasma. The coaxial DBD was ignited under various configurations including different electrode gaps and flow rates of argon, air, and methane gases. Ultimately, this study will provide specific energy transitions and potential radicals observed during plasma ignition, offering valuable information about the chemical species in the plasma for dry gas reforming of greenhouse gases.

Morgan Malone
SURF STEM

Environmental Impacts of UAV/Sensor Combinations in Remote Sensing through Life Cycle Assessments

By: Morgan F. Malone, Jacob Nesslage, School of Engineering; Erin Hestir, PhD

Unmanned aerial vehicles (UAVs) are becoming a common tool for remote sensing and imaging applications in many sectors. This technology is often used to help answer questions about the environment and sustainability, yet the sustainability of the technology itself has yet to be assessed. Previous research at UC Merced has begun to identify the environmental impacts of UAVs being used with imaging sensors by performing life cycle assessments to analyze carbon dioxide equivalent emissions and their relationships with global warming throughout their entire life cycle. This study works to expand upon that research and produce more accurate and generalizable results by 1) conducting a life cycle assessment on an Open-Source Hyperspectral Imager and 2) gathering consumer data from others in the UC system. It is anticipated that this UAV/Open-Source Hyperspectral Imager combination will produce more emissions that contribute to global warming than other sensor options, due to its complexity in resources and functionality. Conducting life cycle assessments provides the opportunity to make knowledgeable suggestions for improvement to reduce harmful environmental impacts at any stage of a product's life.

Rodolfo Galavan Nunez
SURF STEM

Real Time Validation of 2D Control Algorithm for Power Converters in Dual Half Bridge Configuration

By: Rodolfo Galvan Nuñez, Ricardo Pinto de Castro PhD, Iman Ebrahimi

This project validates a 2D control algorithm for power converters in a dual half bridge (DHB) configuration used in hybrid energy storage systems (HESSs). Traditional control algorithms utilizing a single degree of freedom have limitations which may lead to issues such as inaccurate voltage balancing and suboptimal battery aging. This necessitates the development of a 2D control algorithm. The algorithm includes a voltage balancing loop and a current control loop. The voltage balancing loop optimizes energy storage utilization by balancing supercapacitor voltages, while the current control loop regulates energy flow through phase shift computation. Preliminary results show that the proposed 2D control algorithm achieves faster current settling time compared to traditional linear controllers. Furthermore, the nonlinear controller outperforms both the linear and the proposed 2D control algorithm in terms of settling time, indicating superior performance in rapid current stabilization. This research addresses control algorithm limitations, presents a 2D control algorithm, and the findings emphasize the importance of considering nonlinear control approaches for improved power electronics in energy storage applications.

Thomas Kellogg
SURF STEM

CAN Communication in Autonomous Vehicles

By: Thomas I. Kellogg, Ricardo Pinto de Castro

F1tenth is an autonomous vehicle racing challenge that allows students and researchers to learn about and create AI-driven cars at one-tenth the scale of modern racecars. These small robots require complex hardware-software systems that are in constant communication. The purpose of this project is to design a more stable and versatile communication protocol for the F1tenth vehicle, utilizing a CAN vehicle component coordination network. Using this framework, the vehicle shall be able to perform all required activities without software crashes or loss of communication. Upon successful completion of the F1tenth project, this will provide a functional autonomous vehicle that can serve as a model for full-scale robotic initiatives. Self-driving passenger cars, wheeled robots, and similar projects will be able to build off of the research done here in the development of their own ROS-CAN robotic control systems.

Viridiana Hernandez Juarez
SURF STEM

Pre Existing Racial Biases, Chatbots, and Public Services

By: Viridiana Hernandez Juarez, Hanna Kiri Gunn, PhD

Over the years, chatbots have been increasingly used for different purposes including customer services and personal assistants such as Alexa and Siri. A chatbot consists of AI such as machine learning and natural language processing used to mimic or simulate human conversations. Artificial intelligence (AI) tools are now also being used to provide public services. The emergence of AI tools has resulted in significant concern about "pre-existing biases". As Batya Friedman and Helen Nissenbaum explain, there are three kinds of bias that may be present in a computing system including: pre-existing, emerging, and technical ("Bias in Computer Systems", 1996). Preexisting biases occur when an existing bias in a society becomes embedded in a computing system. For example, a ProPublica investigation discovered that racial stereotypes about criminality in the US resulted in a recidivism risk scoring AI system that unfairly rated black defendants as likely to commit future crimes resulting in denials of parole that were not justified. The focus of this project will be on analyzing pre-existing bias within chatbots and their emergence in public services. I aim to explain how these AI chatbots, if they do embed pre-existing biases, result in failures of justice. This project will involve conceptual analysis about relevant ethical concepts, a literature review with an annotated bibliography, and an essay describing preexisting biases within chatbots and public services.

Yuki Yang
SURF STEM

Exogenous thyroxine stimulates cardiac eNOS Protein expression in insulin resistant OLETF and LETO rats mode

By: Yuki Yang, Dora A Mendez, Rudy M Ortiz PhD

Thyroxine (T4) is the most abundant thyroid hormone secreted by thyroid gland which converts to the most active thyroid hormone triiodothyronine (T3) through the process of deionization. Ednothelial nitric synthase (eNOS) is an important enzyme in the cardiovascular system, which catalyzes the production of nitric oxide (NO), vascular remodeling, and angiogenesis. This study explored how does thyroxine hormone influences eNOS expression in the cardiocasular system. Therefore, we hypothesize that T4 stimulates eNOS expression in rat cardiovascular cells under insulin resistant and metabolic syndrome. Insulin resistant, Otsuka Long Evans Tokushima Fatty (OLETF) rats were used to assess the effects of exogenous thyroxine (T4) on glucose metabolism in cardiac tissue. Rats were assigned to four groups: 1) lean, Long Evans Tokushima Otsuka (LETO; n=6), 2) LETO + T4 (8 µg/100g BM/d × 5 wks; n=7), 3) untreated OLETF (n=6), and 4) OLETF + T4 (n=7). T4 increased GLUT4 gene expression by 85% in OLETF and increased GLUT4 protein translocation to the membrane by 328%. Additionally, T4 increased phosphofructokinase-1 (PFK-1), the rate limiting step in glycolysis, by 98% in OLETF. T4 increased AKT and p-AKT by 177% and 134%, respectively, in LETO, but not in OLETF. The prediction of the experiment will be T4 significantly increasing the endothelial nitric-oxide synthase (eNOS) protein expression in heart and the up-regulation of T4.

TUSCEB

The goal of the UC Merced COMPASS: Training Undergraduates in Stem Cell Engineering and Biology (TUSCEB) program is to provide training to UC Merced students in stem cells, regenerative medicine, and related areas in biotechnology to provide them with the knowledge, skills and abilities needed to support the industry's hiring needs for the growing field. The training program is a collaboration across the Schools of Natural Science and School of Engineering targeted to serve undergraduate majors in Biological Sciences and Engineering. The core of the pilot program focuses on inquiry and research-based activities that are scaffolded through three academic semesters and two summer sessions. Along with the core classes and a Capstone project, students participate in undergraduate research, external industry internship, professional development, one-on-one faculty, peer, and industry mentoring, patient and healthcare engagement activities, and community outreach.

The training program launched October 2022 and funded from CIRM'S program on Creating Opportunities through Mentorship and Partnership Across Stem Cell Science (COMPASS).

For more information, please visit https://tusceb.com/

Aaliyah M. Ruiz-Corral
TUSCEB

Identifying Isoforms of the syne1b gene in Zebrafish

By: Aaliyah M. Ruiz-Corral, Emma Gerlt, Stefan Materna, Ph.D.

The syne1b gene is expressed in the Dorsal Forerunner Cells (DFCs) during the early stages of zebrafish development. DFCs are a cluster of cells which migrate together and eventually form a fluid-filled ciliated organ known as Kupffer's vesicle (KV). Kupffer's vesicle acts as the left-right organizer in zebrafish and establishes left-right asymmetry. The syne1b gene is very large (328.5kb) and encodes the nuclear envelope spectrin-repeat protein known as Nesprin-1. Nesprin-1 contains a C-terminal KASH (Klarsicht, ANC-1 and Syne Homology) domain which embeds itself into the outer nuclear membrane and an N-terminal CH (calponin homology) domain which binds to F-actin in the cytoskeleton. It has been observed in previous studies that Nesprin-1 undergoes alternative transcription to express tissue specific variations of the protein. Potential isoforms may lack the actin binding CH domain while others may lack the KASH domain. Currently we are trying to identify which isoforms are expressed in the DFCs during the formation of Kupffer's vesicle. We are using qPCR experiments in order to identify differential expression in the DFCs/KV at the 9 and 12 hour post fertilization time points during development.

Allyzza Raya
TUSCEB

Erythropoiesis in Sclerostin Knockout Mice

By: Allyzza Torres Raya, Jennifer O. Manilay, PhD

The spleen is part of the lymphatic system, and it is a secondary lymphoid organ. The spleen filters the blood cells of the immune system when pathogens are present, recycles iron and blood particles, and houses B cells that produce antibodies. Blood cells are produced in the bone marrow (BM). Previous studies showed that alterations within the BM can modify the function and the structure of the spleen. Hematopoiesis can change if there are changes within the BM cavity. In recent studies, we examined sclerostin knockout (SOSTKO) mice. Sclerostin is an important regulator of bone homeostasis. Romosozumab, a monoclonal antibody that blocks sclerostin, is a new treatment for patients with osteoporotic disease. When there are alterations within the sclerostin levels, it affects specific BM niches that support hematopoietic stem cells and B cells. We examined how age affects the immune cells and how sclerostin deficiency might accelerate immune aging. We hypothesized that sclerostin deficiency accelerates aging of the hematopoietic system in the BM. We are using flow cytometry and histology to assess red blood cell (RBC) development and anatomy of BM and spleen in young and aged mice. Expected observations are that the SOSTKO mice display an increase in RBC production within the spleen and that leads to induction of extramedullary hematopoiesis in the spleen. This study is important because of the possible side effects of romosozumab on hematopoiesis.

Cynthia Navarro
TUSCEB

Impact of Sclerostin erostin Knockout on Hematopoietic Stem Cells and Organs

By: Cynthia Navarro, Jennifer Manilay Ph.D.

Hematopoietic stem cells (HSCs) play a critical role in generating various blood cell types, including those involved with the immune system. For example, Common Myeloid progenitors (CMPs), Granulocyte-Macrophage Progenitors (GMPs), and Megakaryocyte/erythroid progenitors (MEPs) are important immune cells that are derived from hematopoietic stem cells through hematopoiesis. The fate and function of HSCs are influenced by specific microenvironments, located within the bone marrow. Sclerostin, a protein encoded by the SOST gene, is involved in bone homeostasis and its depletion has been associated with increased bone mass which disrupts HSC development. Changes in the bone marrow may cause HSCs to migrate to different locations outside the bone marrow and contribute to age-related decline in hematopoiesis. In this study, we used a B6 mice control group and SOSTKO mice to investigate the effects of blocking sclerostin on HSCs, CMPs, GMPs, and MEPs. Flow cytometry was utilized to analyze these targeted cell types. Furthermore, we aimed to explore the impact of SOST knockout on the kidney and liver through histology. By analyzing the consequences of sclerostin inhibition, we aimed to gain insight into the potential influence of sclerostin on immune cell distribution and organ functionality. Overall, this study explores the intricate relationship between sclerostin, HSCs, and immune cell development/aging while uncovering the potential effects of SOST knockout on the kidneys and livers.

Jose Avila-Garcia
TUSCEB

Engineering a Custom Microfluidic Device to Promote Stable Vascular Lumen Formation for Tissue Regeneration.

By: Jose Avila-Garcia1, Hodah A. Zadeh1, Kara E. McCloskey PhD1.

A microfluidic device often referred to as “organ-on-a-chip” simulates a real organ by having similar flow velocity and 3D structure. Current limitations in stable lumen formation are the ineffective cell culture environment that is created when culturing cells in a 2D dish. The extracellular matrix (ECM) is a configuration of molecules and proteins that surround living cells and tissues promoting and supporting them. The ECM plays an important role by supporting cell movement, differentiation, proliferation, and communication. ECM is found everywhere in the body and theorized to be important for activity of all cell types. Here by using a custom designed microfluidic device for better 3D vessel formation, we will analyze the protein and molecule composition of the ECM in vitro to compare with native ECM found in vivo. In this study the following cells were cultured: human umbilical vein endothelial cells (HUVECs), pericytes, smooth muscle cells, and fibroblasts. The cell cultures will then be decellularized and the engineered ECM made in vitro will be obtained. For future work, using native ECM from a donor and the engineered in vitro ECM, mass spectrometry will be performed to compare the components of the engineered ECM and the native ECM. Engineered ECM can then be modified for regenerative medicine applications for vascular lumen formation.

Luara Gonzalez Rodriguez
TUSCEB

Angiogenic Regulation of Stem Cell-Derived Tip Endothelial Cells

By: Laura Gonzalez,1 Maria Mendoza,2 Kara McCloskey1,2

A well-formed and robust vasculature is critical to the health of most organ systems in the body. However, the endothelial cells (ECs) forming the vasculature can exhibit distinct functional subphenotypes like arterial or venous ECs, as well as angiogenic tip and stalk ECs. The McCloskey laboratory has previously generated highly angiogenic EC subpopulations that exhibit distinct surface markers, gene expression profiles, and positional affinities during sprouting. In this study, the induction of these specialized ECs from stem cells is explored as well as their unique proliferation and migratory rates. Time-lapsed videos show that tip-containing ECs are more migratory compared with nontip-containing ECs and more responsive to antiangiogenic treatment with sunitinib. This data suggests that anti-angiogenesis cancer treatments would benefit from focusing on inhibition of the migrating tip ECs. Keywords: stem cells, endothelial cells, angiogenesis, tip cells, phalanx cells

Marlene Marquez Villanueva
TUSCEB

Cell Density, Location and Size Changes in the Bone Marrow of VHLcKO mice

By: Marlene Marquez Villanueva, Christian Burns, Nastaran Abbasizadeh, Joel A. Spencer Ph.D;

Osteoporosis is a systematic skeletal disorder characterized by low bone mass and current treatment might negatively affect the bone marrow by altering the bone marrow microenvironment. The bone marrow is a primary lymphoid organ where hematopoietic cells, including B cells, develop. Current osteoporosis medication targets von-Hippel Lindau protein (Vhl), which is a regulator of hypoxia inducible factor (HIF) activity. Previous work using a VHL knockout mouse model (VHLcKO) had shown that the deletion of Vhl in subsets of mesenchymal stem cells, late osteoblasts and osteocytes causes a decrease of hematopoietic cells and disruption of B cell maturation. Here, intravital and ex vivo imaging data obtained from a new inducible VHLcKO (iVhlcKO) mouse model will be analyzed for changes in cell density, location and size using the implementation of negative contrast images of the bone marrow. Future results will help gather knowledge of how the deletion of vhl in certain bone marrow cells affect the cell populations of the bone marrow microenvironment.

Maximiliano Gonzalez Barba
TUSCEB

Validation and Functional Study of Novel Ciliary Protein Candidates
By: Maximiliano Gonzalez Barba, Eva Cai, Xuecai Ge, PhD,

The primary cilium is a microtubule-based signaling organelle that plays an important role in neural development. Disrupted cilium formation or function leads to ciliopathies, a wild spectrum of human diseases. Hedgehog(Hh) signaling is an important developmental pathway that relies on the primary cilia and plays a crucial role during embryogenesis and homeostasis in adults. Previously, our lab conducted a ciliary proteomic study using the proximity labeling tool TurboID, and found a group of candidate proteins potentially localized to the cilia. This project focuses on three of such protein candidates: protein A, a non-canonical Notch ligand; protein B, a protein involved in intracellular transport; and protein C, a protein belonging to the Importin family and involved in nuclear protein transport. We use immunofluorescence to identify their localization and qPCR to determine if these proteins play a role in the Hh signaling pathway. Our ultimate goal is to unveil the molecular mechanisms behind normal ciliary function and how aberrations in ciliary function lead to developmental disorders, cancers, and ciliopathies.

Nathan Kamm
TUSCEB

Identifying enhancers of the zebrafish syne1b gene
By: Nathaniel,E, Kamm, Stefan Materna Ph.D

Enhancers are non coding regulatory regions of the genome that facilitate translation by recruiting RNA polymerase indirectly. Enhancers are difficult to find because they do not code for anything and can be easily mistaken for junk DNA. However it is not impossible to find enhancers, through atac seq data, and homology comparison between species as well as other methods potential enhancers can be identified. The enhancers of the syne1b gene are the target of this experiment and by using the atac seq data, homology comparison between species potential enhancers can be identified. Once a list of potential enhancers has been procured a series of reporter constructs using GFP can be made and then injected into the zebrafish embryo for a model organism to gauge expression. This method for identifying enhancers could be applied to many organisms and genes especially in the understudied zebrafish.

Onyinyechi R. Anogwi
TUSCEB

Characterizing Tail Blistering Found In A Zebrafish Septin9a mutant Through Antibody Staining

By: Onyinyechi R. Anogwi, Devina Chavez, Stephanie Woo, PhD

Septin9a proteins are found in the cytoskeleton. They have the ability to interact with Microtubules, thanks to their Microtubule Binding Domain, or MTBD. As the name suggests the MTBD is where a Microtubule would bind to a Septin9a protein. The function of this domain in embryonic development is unknown. Previously, we created a mutation in the zebrafish septin9a (septin9a^ucm110) gene that deletes the MTBD. The homozygous mutants have low to severe blistering on their tail, and the phenotype is incompletely penetrant. My project is to help characterize this phenotype in these fish through antibody staining of Laminin, Fibronectin, and Gamma-tubulin.

Zeth Carmona
TUSCEB

Does Sclerostin Deficiency Accelerate Hematopoietic Aging in Mice?

By: Zeth A. Carmona, Jennifer O. Manilay

Sclerostin is a key regulator of bone homeostasis that plays a crucial role in maintaining bone health. Aging individuals are prone to osteoporosis, a degenerative bone disease characterized by low bone mass, tissue deterioration, and increased fracture risk. Blocking sclerostin with a new drug aims to increase bone mass, but we hypothesize that this may impact hematopoietic stem cells due to reduced bone marrow. In our study, we dissected the femur, tibia, and liver of control and Sost -/- mice, employing flow cytometry to analyze Hematopoietic Stem Cells (HSCs), Common Lymphoid Progenitors (CLPs), and Multipotent Progenitors (MPPs). Histological analysis revealed distinct bone and liver composition. Further investigation is required to fully understand the implications of Sost gene knockout on HSC distribution and bone characteristics. Our research aims to provide compelling evidence for accelerated aging resulting from sclerostin genetic knockout. Key Words: Osteoporosis, Homeostasis, CLP, MPP, HSC, Sclerostin.

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. This program is funded by the University of California Office of the President.

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

Aarthika Atheena
UC LEADS

CCRISPRi enhanced t-fox mediated natural transformation in Vibrio fischeri
By: Aarthika A. Nagarajan, Michele K. Nishiguchi PhD

Natural transformation (NT) is a form of horizontal gene transfer, in which extracellular DNA is taken up in chromosomes by induced bacterial competence and homologous recombination. For many marine bacteria, environmental chitin induces the expression of the tfox protein to begin natural transformation. Interestingly, little is known about the frequency or efficiency this occurs in environmental bacteria, particularly those affiliated with a eukaryotic host. In this project, we examined the response of tfoX transformation under several treatments using two different tfoX-Kan expression vectors: (1) solely tfoX and (2) tfoX plus CRISPRi repression of the DNS exonuclease gene. Specific combinations of natural and artificial environmental conditions, such as low media pH and artificial tfoX protein expression were used to induce NT of exogenously added fluorescently labeled extracellular DNA in Vibrio fischeri strains ES114 (from the Hawaiian bobtail squid Euprymna scolopes) and ETBB1-C from the Australian dumpling squid E. tasmanica. Lowered media pH, high levels of cell culture density, and the expression of tfoX/CRISPRi significantly increased the frequency or efficiency of NT in Vibrio fischeri. Determining the mechanisms of natural transformation in the environment with respect to symbiosis provides insight as to whether beneficial associations and horizontal gene transfer are impacted by abiotic changes in the surrounding seawater.

Baldemar Motomochi
UC LEADS

Validation and functional study of TDP43 and Neogenin in the primary cilium
By: Baldemar A. Motomochi Cedillo, Eva Cai, Xuecai Ge, PhD

The primary cilium, an essential cellular organelle, orchestrates the transduction of various vital signaling pathways. Dysfunction in its structure or activity characterizes ciliopathies, leading to various conditions such as mental disability, hearing loss, retinal dystrophy, obesity, and congenital heart defects. Yet our understanding of the protein composition and dynamics of this critical organelle remains incomplete. Through mass spectrometry analysis of proteins biotinylated within the primary cilium, our lab identified several candidate proteins which putatively localize to the organelle. We focus on two candidate proteins: TDP43 and Neogenin. TDP43, a DNA and RNA-binding protein involved in RNA metabolism, is a known pathological protein in neurodegenerative diseases such as ALS and frontotemporal dementia. Neogenin, a receptor protein which modulates apoptosis, axon guidance, and neuronal differentiation, is implicated in various cancers and neurodegenerative diseases. We aimed to verify their ciliary localization and investigate their effects on ciliary morphology and signaling through analysis of 3T3 cells. We employed immunofluorescence assays to verify ciliary localization and assess cilia morphology. To detect effects on ciliary signaling, we used quantitative PCR to detect changes in mRNA levels of Gli1, an effector in the Hedgehog signaling, a pathway reliant on primary cilia . This research enriches our understanding of primary cilia and contributes crucial insights to the field of ciliopathies.

Desiree Solis
UC LEADS

Quantifying neural indices of cognitive control

By: Desiree Solis, Nancy Rodas De León, and Elif Isbell, Ph.D.

Cognitive control refers to mental processes that are imperative to our ability to process information and control behaviors based on our current goals and social contexts. Studying neural indices of cognitive control is important since impaired cognitive control is implicated in neurodevelopmental disorders. In this study, we compared two commonly used methods of quantifying cognitive electrophysiology, in particular event-related potentials (ERPs): observed waveforms versus difference waves. Although difference waves are generally preferable for isolating experimental effects, previous research suggested they may also obscure experimental effects for specific cognitive control tasks, like the flanker task. We recorded ERPs during a flanker task from 68 adults (Mean age=22.34; 51.39% female). In this task, participants were shown a central arrowhead pointing to the left or right with flanked arrows pointing in the same direction (congruent trials) or the opposite direction (incongruent trials). Participants were instructed to respond with a left-hand button when the central arrowhead was facing left, and a right-hand button when the arrow was facing right. We measured the magnitude (amplitude) and the timing (latency) of the observed waveforms (congruent and incongruent) and the difference wave (incongruent-congruent). The ERP data collection and processing are complete. The data analyses are in progress and results will be presented at the UROC symposium. Our study will inform research practices for quantifying ERPs collected during cognitive control tasks.

EunSang Park
UC LEADS

Modeling Infectious Disease Spread: Comparison of the Agent-Based-Modeling and Differential-Equation Approaches

By: EunSang Park, Changho Kim, PhD

In epidemiology, the SIR model is commonly used to describe the population dynamics of infectious diseases. It divides the population into three categories: Susceptible, Infected, and Recovered. We consider two approaches to describe its population dynamics. In the ordinary Differential Equation (ODE) approach, we solve a set of differential equations that describe the rate of change of the fraction of each category. In the Agent-Based Model (ABM), we keep track of the state of each person and its position in a two-dimensional lattice. The ODE model has two model parameters, the infection strength b and the recovery rate k, whereas the ABM has three model parameters describing the diffusion, infection, and recovery rates. Our research aims to compare the two approaches and to establish a relationship between the ODE and ABM parameters. To find the optimal values of the b and k parameters that give matching results to the ABM simulation results, we employ two methods. In the first method, we determine the optimal b and k values by minimizing the differences between the curves generated by the ODE and ABM approaches. In the second method, we use an established relation between the end-state ratio of uninfected people and the contact number b/k. Our results show that these two estimation methods give consistent results and explain the fast-diffusion limit situation.

Jesus De La Mora
UC LEADS

The phenomena of tribology: Varnish removal from metal surfaces in mechanical components.

By: Jesus De La Mora, Arturo Morales and Ashlie Martini

Varnish forms when the lubricating oil is exposed to water, dust and ambient conditions that accelerate the oxidation process and deteriorate its properties. Varnish formation in mechanical devices is a challenge because the deposits on metal surfaces could affect the proper flow which can lead to functionality issues. In our lab, using a custom test ring, we test the performance of chemical cleaners and evaluate their efficiency at removing varnish. The different testing conditions influence varnish removal rate and allow us to make visual and mass measurable comparisons to determine the performance of the chemical cleaners. Furthermore, the testing cell was sealed with elastomers. Those elastomers were tested to observe the effect of chemical cleaners on their mechanical properties. By preventing varnish formation and ensuring proper sealing, this project promotes reliability and efficiency in mechanical systems. Varnish removal research makes a great contribution to keep components working at optimal performance for longer periods of time.

Logan Adrian
UC LEADS

Temperature-dependent Quality Factor Measurements of a λ/4 Niobium Superconducting Radio Frequency (SRF) cavity via Dilution Refrigerator Upgrades.

By: Logan T. Adrian, Jay E. Sharping, PhD.

SRF cavities are essential components in the process of driving technological advancements in particle accelerators and quantum computers. When placed inside a dilution refrigerator, these cavities exhibit superconducting properties, expelling magnetic fields and minimizing resistivity. By injecting a microwave signal into a λ/4 niobium SRF cavity, its low energy dissipation capabilities result in a high quality factor, enabling energy storage with minimal losses. Upgrades implemented on dilution refrigerators include optimizing temperature conditions and incorporating translation stages for position manipulation, facilitating comprehensive measurements of the quality factor of the λ/4 niobium SRF cavity at various temperatures. This data enhances our understanding of the cavity's performance characteristics but also paves the way for its broader applications in quantum computing and nano-sensing.

Mabel Espinoza
UC LEADS

Social Life Cycle Assessment of Strawberry Production in the Central Valley of California

By: Mabel Espinoza, Colleen C. Naughton PhD

California is the leading state of strawberry production, producing 90% of U.S. strawberries. Harvesting and processing of strawberries is highly labor intensive. With the ongoing effects of climate change in California, strawberry production will be more challenging. In order to keep up with strawberry demand, there has been the development of agriculture technology. The primary goal of this research is to assess the social, positive and negative, impacts of strawberry production in the Central Valley of California. We will utilize the Social Life Cycle Assessment methodology for the workers and the three sub-categories of: Health and Safety, Fair Salary, and Working Hours. Under health and safety, we investigated the possible chemical exposures, such as Azoxystrobin and 1,3-Dichloropropene, and required personal protective equipment to assess health impacts. Further, we used CalOSHA data to evaluate the reported injuries. WCIRB was used to extract compensation rates. California EDD was used to investigate average employment and earnings for fair salary and working hours. Higher impacts for health and safety were found in the planting and harvesting stages compared to packaging and transportation. Not all data was available by stage of strawberry production, and a more in-depth survey is needed. Assessing strawberry production from cradle to gate, will allow us to thoroughly evaluate the social impacts to create collaborative solutions and sustainable practices such as mechanization.

Maria Contreras
UC LEADS

Exploring the Physicochemical Relationship between Soil Spectral Signatures and Biodiversity: A Comparative Study of Agriculture and Riparian Environments

By: Maria E. Contreras, Jacob Nesslage, Morgan Malone, Erin Hestir, PhD

The loss of biodiversity due to human activities is a growing global concern. Understanding the relationship between ecological communities and the physical conditions of their environment, such as the physicochemical properties of the soil, opens a window of knowledge on the prevention of biodiversity loss. Soil spectroscopy allows us to make quantitative measurements of the physicochemical properties of soil to explore relationships between soils and ecological communities. The objective of this study is to compare the soil spectral signatures of two ecosystem types within an agriculture-dominated landscape, agricultural and riparian, and determine how the physicochemical properties of the soils influence the biodiversity of each ecosystem. The VIS-NIR spectroscopic analysis included both sieved and unsieved soils from 68 sites, split equally between agricultural and riparian ecosystems along seventeen 150m transects. Utilizing spectral data analysis techniques, such as Euclidean distance, Jeffries-Matusita distance, Pearson correlation coefficient, and spectral angle, we assessed whether or not there is a significant difference between soils with respect to ecosystem type and how the biodiversity of each area relates to soil composition. The anticipated results are that, although quantitative measurements from soil spectroscopy often reveal properties not seen by the naked eye, there will not be a significant difference in the spectral signatures between agriculture and riparian samples. This study will provide valuable insights into the intricate relationship between soil composition and biodiversity conservation.

Rida Mirza
UC LEADS

Evidence for accelerated immune aging and cardiac events in sclerostin-deficient mice
By: Rida Mirza, Jennifer O. Manilay Ph.D.

Osteocytes are crucial cells for bone formation as they secrete growth factors, such as sclerostin (Sost), which inhibits bone formation. Numerous bone-related diseases have been linked to mutations in the Sost gene. In sclerostin knockout (Sost-/-) mice, there is an abundance of bone density and a decrease in the bone marrow (BM) cavity, which is also the site of hematopoiesis. Sost-/- mice exhibit BM-specific persistent low-grade local inflammation that has some resemblance to "inflammaging." We propose that BM sclerostin deficiency accelerates hematopoietic system aging. We will compare control and Sost-/- mice at 4 months, 6 months and 19 months of age. By employing flow cytometry, the lymphoid and myeloid BM populations will be measured, in particular, inflammatory monocytes in the BM that are known to increase during normal aging. In some studies, depletion of sclerostin has shown to increase the risk for cardiovascular events. We will perform histological analysis of the hearts from control and Sost-/- mice. We propose that sclerostin deficiency impacts the arteries within the heart and increases risks for cardiac events within mice. Our findings will reveal whether BM microenvironments with low sclerostin levels display accelerated aging, and lead to new studies to reveal the processes by which Sost-expressing cells affect the lymphoid and myeloid niches in young and old sclerostin-depleted animals. This research will provide insight into the role of sclerostin in the immune system as well as other organs and provide more knowledge forage-related bone diseases.

Steven Umbarger
UC LEADS

Visualizing Giant Molecular Clouds and the Star Clusters That Form Within Them
By: Steven R. Umbarger, Sarah R. Loebman, PhD

Stars are born in open star clusters when large regions of cold molecular gas and dust in space, giant molecular clouds (GMCs), meet a density threshold for star formation. By looking at simulations of GMCs, the relationship between these clouds and open star clusters can be determined. We used both the Friends of Friends Python code and developed our own visualization package to easily and clearly see individual GMCs and the star clusters that form inside of them. In this work, we present our analysis run on FIRE-2 (feedback in realistic environments) galaxy simulations from the Latte suite of Milky Way-like galaxies. We started with one galaxy and focused on visualizing one GMC at one particular moment in time. Then we generated multiple images of the same GMC over time to track the full evolution of the gas and the star cluster that formed within it. We hope to make this code accessible and available for the astrophysics community to use in the future. With this data, we can form a deeper understanding of the influence of galactic structure and its environment on the formation of star clusters.

UCM Mexico Climate Research

The UC Merced-Mexico Undergraduate Climate Research Program is part of a Chancellor's initiative to increase exchange and collaboration between UC Merced and Mexican higher education institutions. This year, UC Merced invited students from Mexican partner universities who are interested in climate-related research and considering graduate study to apply for the nine-week program. The participating twelve students, from Instituto Politécnico Nacional, Universidad Autónoma de Baja California, Universidad de las Américas Puebla, and Universidad Nacional Autónoma de México, conduct directed research on climate-related topics with faculty mentors and graduate students from engineering and natural and social science disciplines. The students also participate in activities to prepare them for graduate school. It is anticipated that this year's program is only the first instance of an annual program to bring Mexican undergraduates to UC Merced during the summer to research a variety of issues affecting both the US and Mexico.

Alejandro Montiel Torres
UCM Mexico

ELeopard Shark Teeth Track Seasonal Life History Patterns Between Estuarine and Marine Ecosystems with Stable Isotopes.

By: Alejandro Montiel Torres, Jonathon P. Kuntz, Sora L. Kim

Changing environmental conditions in the late 20th century have contributed to shifts in animal distributions and migration patterns. The Leopard Shark (Triakis semifasciata) population of Northern California is one species that has experienced recent declines, highlighting a need for conservation efforts. Stable isotope analysis (SIA) can provide valuable insights into shark life history ecology. By replacing their 6-7 rows of teeth within the jaw every ~45-55 days, Leopard Sharks create a unique timeline that records stable isotopic ratios across the last year of life. The isotopic composition (δ 18O) analysis of enameloid in shark teeth tracks salinity and temperature changes experienced by each individual. Utilizing this approach allows us to reconstruct movement patterns between brackish and marine environments, as well as between warmer and colder waters over time. The combination of SIA along a timeline of teeth offers an illuminating perspective on Leopard Shark ecology, which is vital for effective conservation measures of the Leopard Shark in a changing climate.

Ana Lucía Loera Lafont Serrano
UCM Mexico

Synthesis of carbon capture agents

By: Ana Lucía Loera Lafont Serrano, Dellamol Sebastian, PhD

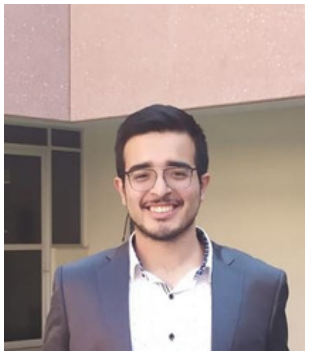
The project aims to address the impact of CO2 emissions and mitigate the consequences of climate change through CO2 capture. To achieve this, a new model is proposed to identify the optimal CO2 capture agent. Previous research indicates that there are different effective carbon capture agents for sequestering specific gases. In this study, multiple potential compounds are being prepared to identify the best carbon capture agent. Trifluoromethyl pyrazole, 4, 4'-Bipyridyl, and Pyrazole are being used as the precursors for the synthesis of these carbon capture agents. Furthermore, different conditions are being employed for the successful synthesis of the carbon capture agents to maximize the expected started material. To characterize the samples, Nuclear Magnetic Resonance spectroscopy (NMR), Thin Layer Chromatography (TLC), and Infrared Spectroscopy (IR) are being employed. The successful capture of CO2 will not only contribute to the development of a new project but also help mitigate the adverse effects of climate change.

Aphril del Socorro Pérez Flores
UCM Mexico

Identifying linkages between domestic well failures, droughts, and the food-water nexus in the Central Valley.

By: Aphril del S. Pérez-Flores; José M. Rodríguez-Flores, and Josué Medellín-Azuara, P.h.D

This study examines the potential correlation between domestic well failures, drought, and food-water relationships in California's Central Valley; identifies hotspots in California for dry wells; and analyze the contextual factors potentially associated, including groundwater basin characteristics, water use, and water scarcity during droughts. The preliminary analysis suggests that specific factors such as aquifer characteristics, water usage, and crop types may contribute to domestic well damage during dry periods. To achieve this, the study employed an extensive review and analysis of existing literature and research articles on dry wells and droughts in California and elsewhere. By synthesizing information and data from various sources, the study developed a comprehensive understanding of the intricate dynamics among domestic well failures, droughts, and food-water relationships in the Central Valley. Understanding the connections between domestic well failures, drought events, and food-water is essential for devising targeted interventions that mitigate water scarcity and alleviate its detrimental effects on domestic water supply and agricultural productivity. By identifying the specific factors contributing to well failures, stakeholders can implement measures to enhance water resilience in the region. Additionally, the study's findings will contribute to a broader knowledge base by consolidating existing research and identifying areas of knowledge gaps, thereby informing future research endeavors and policy decisions concerning water resources and food production in the Central Valley.



Bernardo Alberto Vargas Vidal
UCM Mexico

C-F bond functionalization in fluoroaromatics and aliphatic poly– and perfluoro molecules using a well-defined non-heme manganese (II) complex

By: Bernardo A. Vargas Vidal, Víctor Durán Arroyo, Rebeca Arevalo, PhD

Recent advances in C–C bond cleavage with the use of a well-defined non-heme manganese (II) complex [Mn(dtbpy)2(OTf)2] to produce carbonyl compounds has motivated us to pursue C–F bond functionalization in fluoroaromatics and aliphatic poly– and perfluoro molecules. The functionalizing agent pinacolborane (HBPin) was chosen to achieve synthetically useful C–B bonds containing molecules for use in the pharmaceutical industry. This Mn-based approach would afford a greener alternative to previous works that heavily rely on the use of toxic and expensive metals (i.e, Ir, Pt, Rh) because of manganese's low toxicity and high abundance as the third most abundant transition metal in the Earth's crust. Thus, we aim to expand the available pool of green catalysts able to recycle harmful fluorochemicals whereby results will be analyzed and characterized via nuclear magnetic resonance (NMR), gas chromatography (GC), and infrared (IR) spectroscopy. Future research will focus on optimizing conditions upon favorable results, using different Earth-abundant metals, and mechanistic elucidation.

Emily Rivera Mondragon
UCM Mexico

Local Climate Program Adoption in Mexico and California

By: Emily Rivera, Paul Almeida, PhD

This study examines the adoption of voluntary environmental programs (VEP) at the local level in Mexico and the United States. The primary objective is to comprehend the factors influencing a city's decision to decision to participate in a program aimed at reducing greenhouse gas emissions and implementing climate-friendly policies. Specifically, the research compares the Covenant of Mayors Program in California and Mexico to ascertain if cities in different countries adopt climate policies for similar reasons. To explore the relationship between VEP adoption and city-level and demographic characteristics, a set of hypotheses is tested. These characteristics include the type of industrial activity, educational levels, the political party in power, and the extent of social movement activity. The research methodology employs multivariable regression analysis, enabling the examination of multiple variables simultaneously. Preliminary findings indicate that specific city-level and demographic factors significantly impact the decision to join VEPs. The results suggest that cities with higher educational levels, a diverse industrial base, and greater social movement activity are more inclined to participate in these programs. In conclusion, this study sheds light on the factors that influence the adoption of voluntary environmental programs at the local level in Mexico and the United States. The findings contribute to a better understanding of the motivations underlying cities' decisions to implement environmentally conscious policies.

Gyselle Alexandra Godinez Castillo
UCM Mexico

Unraveling the Role of CLK Proteins in Leafhoppers: molecular insights through X- Ray Crystallography

By: Gyselle A. Godinez Castillo, Luisa R. Garcia Michel, Michael Thompson Ph.D

CLK (Cdc2-like kinase) proteins act as internal switches, sensing and coordinating physiological processes in response to temperature changes. Understanding the mechanisms of temperature sensing in leafhopper CLK's provides valuable insights into climate change, as this regulation significantly impacts their physiological processes, behavior, and ability to adapt to environmental changes. It is uncertain if this switch will break as global temperature increase, and how this can affect leafhoppers. To address this question, we are investigating leafhopper CLK proteins to understand how temperature changes structure and enzyme activity of this molecular thermometer. To obtain this protein artificially, we perform recombinant protein expression in E. coli, proteins are then subjected to a high-affinity chromatography purification process followed by X-Ray Crystallography structure determination at physiological temperature as a tool for revealing molecular details of CLK proteins. In addition, we will perform kinetic assays to understand the kinetic parameters of CLK activity, knowledge that is essential for comprehending biological functions and regulatory roles of CLK proteins, as well as for developing a predictive model for the effect of rising environmental temperatures on leafhoppers. This will be the first study focused on the structure of leafhopper CLK proteins, and understanding molecular insights of the structure of leafhoppers can provide us more information about the function of CLK proteins and the impacts on climate change.

Ilse Judith Pérez Jiménez
UCM Mexico

LVTS Challenge with Reinforcement Learning

By: Ilse Judith Pérez Jiménez, Ricardo Pinto de Castro, PhD, Iman Abraham, MS,

Since the industrial revolution, there has been an increase in pollution around the world. In this century, tons of companies have developed some ideas for fighting against this problem. Hybrid cars have done a good job as a source of new ways to manage energy without using fossil fuel as the primary source. The following paper provides a solution to the Energy Management Algorithm using reinforcement learning. Reinforcement Learning Toolbox is an app that trains policies using reinforcement learning algorithms such as DQN (Deep Q-Network), PPO (Proximal Policy Optimization), SAC (Soft Actor Critic), and DDPG (Deep Deterministic Policy Gradient). This app is provided by MATLAB Simulink, the model of the car used during the research is represented in the Functional Mockup Unit that runs in Simulink. This Functional Mockup Unit is the standard for the VTS Challenge of 2023, which is a contest organized by the IEEE Vehicular Technology Society.

Ivan Huirache Rodriguez
UCM Mexico

The role of climate change in modulating Colorado River Basin's water allocation to California and Mexico

By: Ivan Huirache Rodriguez, D. Eduardo Guevara Polo, John A. Abatzoglou, Josue Medellin-Azuara & David Rheinheimer

The Colorado River Basin (CRB) system plays a crucial role in supplying water to California and Mexico, supporting various sectors such as agriculture, industry, and domestic use. However, climate change triggers shift in precipitation patterns, and rising temperatures. This study focuses on assessing the impact of climate model ensembles on the CRB system's water supply. By analyzing multiple climate models and emission scenarios, this study examines projected changes in water allocation to California and Its subsequent influence on deliveries across the border down to Mexico's Water. This preliminary research provides valuable insights into future water supply, contributing to an enhanced understanding of the system under different climate conditions. The findings reveal a sizeable decrease in water supply from the CRB system for both California and Mexico. This is primarily from reduced precipitation across scenarios, leading to water scarcity. Additionally, higher temperatures intensify evapotranspiration rates, further exacerbating the demand for water, particularly in agriculture. These combined effects present significant challenges for water resource management in the region. The study highlights the importance of proactive water management to mitigate the adverse effects of climate change on the CRB system. Strategies such as water conservation, infrastructure upgrades, managed aquifer recharge, and exploring alternative water sources are necessary to address these challenges effectively.

Jazmin Vidal
UCM Mexico

Climate Change Vulnerability of Protected Areas of Baja California and Baja California Sur, Mexico

By: Jazmin Eunice Vidal Olmos, Ph. D. Jeffrey Jenkins.

The arid Baja California peninsula is expected to face the impacts of climate change, such as rising temperatures, reduced precipitation, and more extreme weather events. These effects manifest differently across different ecoregions, including mountain, desert, and island landscapes. Ecosystems centered around protected areas play a crucial role in providing services to the surrounding landscapes, such as water provisioning and serving as climatic refugia for flora and fauna. Consequently, they are vital for enhancing the climatic resilience of the broader region. In this study, we conduct a climatic vulnerability assessment of the resources within these protected areas to gain insights into the exposure and sensitivity of socioeconomic and ecological factors influencing vulnerability. By contextualizing potential impacts, this assessment demonstrates the utility of vulnerability assessments for managers. It allows them to assess the potential impacts to protected areas and the ecosystem services they provide, and subsequently develop necessary adaptation measures. Through this research, we aim to highlight the importance of understanding the vulnerability of protected areas in the face of climate change. By recognizing and addressing potential impacts, managers can take proactive steps to safeguard these critical ecosystems and their associated services, contributing to the long-term resilience and sustainability of the Baja California peninsula.

Maribeth Krieg Puga
UCM Mexico

Design and synthesis of proactive organic molecules for energy storage

By: Maribeth Krieg Puga, Ryan D. Baxter, PhD,

A research study is currently underway to identify and develop proactive organic molecules designed for energy storage purposes. The primary focus of this study is to apply these molecules in the field of agrivoltaics, which involves the combined use of land for both agriculture and solar photovoltaic systems. The aim is to mitigate the climate impact generated by traditional field crops and solar farms. The study involves a laboratory-based approach, encompassing the design and synthesis of these organic molecules.

Michelle Escobar Landero
UCM Mexico

Influence of temperature on Wolbachia density in Culex pipiens. Implications for West Nile Virus transmission

By: Michelle Escobar Landero, Andrea Joyce, PhD

Wolbachia is a common endosymbiont found in a wide variety of wild insects including butterflies, dragonflies, moths, and mosquitoes, including the mosquito Culex pipiens. Infection with Wolbachia protects the mosquito from viruses since it blocks the virus's replication. High environmental temperatures are known to decrease Wolbachia density, which could result in higher infections with infectious diseases that could be transmitted to humans such as West Nile Virus. Climate change will increase temperatures in the Central Valley, and increase our vulnerability to West Nile transmission since it is known that Wolbachia does not survive high temperatures.This study will examine Wolbachia density in Culex pipiens mosquitoes by DNA extraction processes and qPCR testing in adults collected with carbon dioxide baited traps across strategic points in Merced during summer. Through the obtained results from the research, infected mosquito releasing strategies could be considered and evaluated according to the area's temperature.

U-RISE

The goal of the Undergraduate Research Training Initiative for Student Enhancement (U-RISE) program is to develop a diverse pool of undergraduates who complete their baccalaureate degree, and transition into and complete biomedical, research-focused higher degree programs (e.g., Ph.D. or M.D./Ph.D.).

Maria Isabel Ruiz

U-RISE

Acute Food Deprivation Does Not Induce Changes in Body Mass or Lipid Panel in West Indian Manatees (Trichechus manatus)

By: Maria Isabel Ruiz, Carla Rivera, DVM, Antonio A. Mignucci-Giannoni, PhD, Rudy M. Ortiz PhD

Acute food deprivation induces metabolic shifts relying on lipid metabolism to sustain homeostasis in marine mammals. Lipid utilization depends on diet, metabolic rate, environmental conditions, and food availability. Manatees are herbivores with large fat depots that can reduce their metabolic rate by 23% when fasting. However, the contributions of lipid metabolism during fasting and refeeding remain poorly understood. Three captive manatees were unfed for 60 hours, then refed. Body mass (BM) was measured before and after an acute fast. Plasma samples were collected 16 hours post-prandial control, 40 and 64 hours after food deprivation, and 16 hours post-re-feeding. Prior to deprivation, mean BM was 107.3±5.2 kg, and 100.1±4.3 kg after deprivation. LDL increased after 40 hours of fasting and decreased at 64 hours, whereas HDL peaked at 60 hours post-fast and decreased during refeeding. TG and VLDL increased after refeeding; however, there were no significant changes between deprivation and refeeding in the lipid panel. These results indicate that from a metabolic perspective, these animals can tolerate at least 60 hours of acute deprivation well, which could be sufficient time for them to find new feeding grounds when food is scarce.

Marisol Hernandez Garcia

U-RISE

4-Week Oral Cannabidiol Demonstrated the Therapeutic Potential to Reduce Risk Factors of Met-S

By: Marisol Hernandez Garcia, Jessica Wilson M.S, Dora Mendez, and Rudy M. Ortiz Ph.D

Cardiovascular disease (CVD) is the leading cause of death globally, and metabolic syndrome (MetS) is a precursor of CVD. Lipid peroxidation, resulting from dysregulation of free radicals, may contribute to the MetS-associated hypertension and systemic inflammation. The antioxidant and anti-inflammatory properties of cannabidiol (CBD) are well recognized. We hypothesize that chronic H4CBD treatment in a model of MetS, the Otsuka Long-Evans Tokushima Fatty (OLETF) rat, will decrease 4-hydroxynonenal (4HNE), a marker of lipid peroxidation, and transforming growth factor-beta 1 (TGFβ-1), a marker of systemic inflammation. Rats were assigned to three groups (n=8/group): (1) control, Long Evans Tokushima Otsuka (LETO), (2) untreated OLETF, and (3) OLETF + H4CBD (200 mg/kg/day x 4 weeks). After 4 weeks, hearts and plasma were collected from each rat to measure heart 4HNE and plasma TGFβ-1. Because H4CBD has been shown to reduce systolic blood pressure in OLETF, we anticipate that heart 4HNE and plasma TGFβ-1 levels will be lower than in the untreated OLETF rats. In the larger context, these changes suggest that chronic treatment with H4CBD can potentially mitigate some critical factors associated with Met-S, such as oxidative stress, inflammation, and hypertension. This could imply that CBD may have therapeutic potential for managing Met-S and reducing the risk of CVD.

UROC-H

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 promising UC Merced undergraduate students each year in faculty-mentored research during the summer and prepare them for advanced education in the humanities and humanistic social sciences.

This collaborative program led by UROC, the Graduate Division, and the School of Social Sciences, Humanities, and Arts is made possible through a grant from the Mellon Foundation. Learn more at mellon.org

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

Alex Luu
UROC-H

"Down With the Eagle and Up With the Cross": White Supremacy's Evolution and its Impact on the January 6th Capitol Insurrection

By: Alex T. Luu, Sean L. Malloy, PhD

My research focuses on the Proud Boys and Oath Keepers' roles in the January 6th, 2021 Capitol insurrection and their links to the militia movement of the 1990s and the Ku Klux Klan's third iteration. Historical archives such as the FBI Vault, newspaper and journal articles, and federal court documents lay the foundation for understanding the evolution of organized white supremacy and far-right ideology from the Klan through to these more recent groups.The Proud Boys and Oath Keepers rebelled against the federal government and the far-Left through extralegal violence because they believed the government had betrayed its people and progressive ideals harmed the nation. They redefined white supremacy from neighborhood Klan groups to national, far right, militarized organizations motivatived by the belief that the federal government no longer serves the people. Through fear and propaganda, people of color joined in hopes of achieving far-Right values. However, these aspirations were short-lived with the Capitol riots failing to achieve its goal and many of its members arrested.

Anaya Cambridge
UROC-H

Native Americans in Higher Education

By: Anaya N. Cambridge1, Robin M. DeLugan, PhD1

This research analyzes the opportunities and barriers Native Americans face in higher education in the United States and Canada. Native Americans have the lowest enrollment and graduation rates of all racial and ethnic minority groups that seek out higher education and are the only group to have not experienced a consistent rise in attendance. Phase 1 of the research project analyzed data and scholarly literature about the problem, including potential solutions. This resulted in an annotated bibliography. Databases used for this search includes JSTOR, ERIC (Ebsco), and the University of California, Merced Library's advanced search. Key search terms used include: Native American, American Indian, University/college/higher education, and retention. Of the three databases used, an average of 163 results were found. After the screening process, 5 articles were selected for analysis. The bibliographic research lays the groundwork for Phase 2 (Fall 2023) that will involve visits to select University of California campuses where ethnographic research will be conducted with Native American students, faculty, and staff about their university experiences. The goal of interviews and participant-observation fieldwork with the Native American campus community is to provide information about what is working, what can be improved, and potential solutions to enhance the academic experience of Native Americans in higher education.

Angelica Cardenas
UROC-H

Measuring the success of the UC Merced Public Health Living and Learning Community

By: Angelica Cardenas, Lindsay Crawford Ph.D.

Living learning communities (LLCs) are residential programs that are made up of a small cohort of undergraduate students assigned to a specific subject area. The public health living learning community is made up of about 30 incoming freshmen who have all indicated interest in learning about public health. Living learning communities provide a supportive learning environment and help foster growth for students academically, personally and professionally. The goal of this research is to measure the success of the public health LLC. This study review will focus on the professional development of the students in the cohort and will use a mixed-methods approach. Qualitative data used will be surveys gathering information to better gauge how much exposure students have had to professional development. Quantitative data collected will be counting how many professional workshops students have attended. Data from LLC students will be compared to non-LLC students to better understand the differences between each cohort of students.

Ashley M. Ratcliff-Winn
UROC-H

Cantos de Trabajo de Colombia-Venezuela

By: Ashley M. Ratcliff-Winn, Bristin Scalzo-Jones PhD

In 2017, UNESCO declared Colombian-Venezuelan cantos de arreo y ordenó, (herding and milking songs) as Intangible Cultural Heritage in Need of Urgent Safeguarding. These cantos, which derived from the Colombian-Venezuelan Llanos (plains), are one of seven cultural heritage practices recognized by UNESCO and are the only practice of its kind that showcases the complex relationship between inter species communication. My research will focus on the teaching-learning process of these cantos and how different learning models affect the success of these different processes in new generations of song bearers. By bringing attention to these cantos and their cultural and ecological contexts, this research will focus on the importance of preserving them and the inter species relationship that they perform. Due to the lack of research conducted and scarce studies that do exist, which focus on these cantos and their preservation, risks the loss of this knowledge. Failure to preserve these cantos would result in significant cultural loss to the people of the Colombian-Venezuelan Llanos. By utilizing and interviewing professionals within this field of study, analyzing documentaries provided by UNESCO, and gathering texts from The University of California's extensive library archives, I plan to focus on deciphering and analyzing the musical component of these cantos.

Citlali Perez Lopez
UROC-H

Colombian-Venezuelan Cantos de Arreo y Ordeno: An Analysis of the Cow's Communication, Behavior and Human-Animal Interaction.

By: Citlali Perez Lopez, Bristin Jones, Ph.D.

In this chapter, there will be an analysis of Colombian-Venezuelan cantos de ordeño y arreo (milking and herding songs), specifically a close analysis of the cow's communication and behavior, which connects to the human-animal interaction. UNESCO declared these cantos in decline due to the highly industrial mechanized farming system in the llanos. Now, the llanero (farmer) has been replaced for machines, as a result, their practices and these songs are at risk of disappearing. My chapter, which provides a close analysis of how the llaneros (farmers) are able to understand and identify the cows' emotional state and well-being, how the cows respond vocally and physically to positive and negative situations, and lastly the practices llaneros use in order to facilitate their work and have a positive interaction with the animal. Using videos/documentaries and/or possible interviews of llaneros' testimonies and their personal experiences when working closely with animals will helps us understand this relationship. By introducing research focused on these cantos from different perspectives, my team and I aim to contribute to the preservation and to relevance of the different aspects within these cantos.

Daniel Lopez
UROC-H

Black Sociologists Underrepresented in PhD Programs, an Examination of Racism and Roadblocks

By: Daniel Lopez, Dr. Whitney Pirtle

Black scholars in higher education make up the most sociology degrees among non-White students but not many of these Black students make the transition to a P.h.D. because of what could be a "leaky pipeline." This research project examines how racism/roadblocks interfere with the advancement of Black sociologists in higher education. I will be utilizing both qualitative and quantitative methods; the qualitative being in the form of a comprehensive literature review and the quantitative in the form of analyzing a survey. The online survey was taken by Black Sociologists with a Ph.D. in the United States (n=51) and asked participants questions about their experience in higher education and how it may have been affected because of their race. By analyzing the survey responses it seems that networking with other professors seems to be efficient in the success of Black PhD scholars. The purpose of this project is to reveal any roadblocks/blockages in the Ph.D. pipeline for Black scholars and determine how networks help advance the trajectory for those Black scholars who stay in the pipeline.

Darian Andrade-Diaz
UROC-H

Examining the Leaky Pipeline of Black PhD Professionals: How Networks and Racial Climates Impact Career Advancement in Sociology

By: Darian F. Andrade-Diaz, Whitney Pirtle, PhD

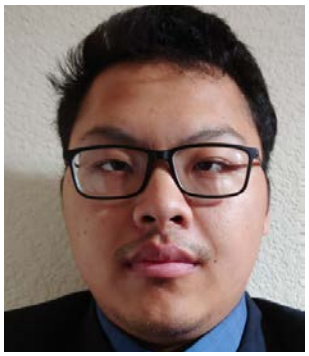
There is underrepresentation of Black professionals in higher education, which is an inequity that can lead to a lack of social justice, support systems, and retention of students of similar backgrounds. This study examines roadblocks and inroads that exist for Black PhD professionals working in academia. The research questions addressed are: (1) How do pathways and networks shape the advancement of Black sociologists in the academy? (2) How does racism and/or roadblocks interfere with advancement? The emphasis was placed on factors that perpetuate a phenomena known as “the leaky pipeline” where Black professionals are not able to advance in their careers. Black PhD professionals (n=51) answered a series of questions in a survey that yielded quantitative and open-ended qualitative data. The survey was conducted over the course of one year, (July 2021-July 2022) with two six-month check-points (December 2021 and July 2022) to assess data collection progress. The data gathered gives insight into the participant’s networks, how they experience the racial climate in their work environment, and how their network shaped their advancement. We expect to find correlations between participants’ networks and their advancement in academia as well as a drag to their advancement related to the racial climates at the institutions where they work.

Estefani Cruz Cruz
UROC-H

Colombian-Venezuelan Cantos de Arreo y Ordeño: The Power of Music and Interspecies Connections

By: Estefani Cruz Cruz, Bristin Scalzo Jones, PhD

Born from generations of rural farming in the Colombian and Venezuelan grass plains known as the llanos, cantos de trabajo are songs sung by llaneros to their cattle. This oral tradition is integral to their daily milking and herding routines, arreo y ordeño respectively, both styles being performed for distinct functions. This project examines the role of music and voice in the unique interspecies connection formed between farmer and cow. Close readings of lyrics and recordings found in books and articles provide insight into the content of the cantos outside of their practical benefits and reveal the co-dependent nature of this cultural practice. Cross-referencing research on music therapy corroborates these work songs’ ability to transcend language barriers, a quality that distinguishes it from other farming methods. Despite this, Colombia and Venezuela's growing factory farming industries have made meat and dairy production large-scale, leaving cantos de trabajo to fade out of practice. The preservation of these songs has broader implications for our endangered communication with other species and knowledge of how to form those connections.



Jefferson Yang
UROC-H

Farmworker Health In California

By: Jefferson Yang, Paul Brown, Ph.D. Mellisa Renteria, M.D. Ana Lucia Mendoza,

The research project aims to explore the socioeconomic factors that impact the health of farm workers. Our study will leverage data from the recently concluded Farmworker Health Study, involving a comprehensive survey of more than 1500 farmworkers across various regions in California. To gain insights into the socioeconomic context, we will utilize the Healthy Place Index, a community-level indicator of socioeconomic status. The project's objective is to generate a research paper that analyzes the socioeconomic factors influencing the health of farmworkers in California. The conducted survey has made the data available, which will aid in gathering further information to establish a connection between individual and community-level measures of socioeconomic status. Many farmworkers have diminished social and economic rights, which is critical for understanding the organization of agricultural work and its implications for farmworker health.

Jeremy A. Reyes
UROC-H

CCow Song: Interspecies Communication in Colombian-Venezuelan Cantos de Arreo y Ordeño: Sociopolitical and Socioeconomical Analysis

By: Jeremy A. Reyes, Bristin C. Jones, PhD

This paper presents the exploration and analysis of cantos de arreo y ordeño, and its decline in use among indigenous ranchers from Colombia and Venezuela. These songs are defined as work songs utilized in order to communicate with livestock for a variety of purposes, such as moving to a different field, informing the time of day, cautioning the type of terrain, and more. This practice is derived from the indigenous communities that originate from Los Llanos, a geographical region shared between Venezuela and Colombia, and as such was declared an Intangible Cultural Heritage in “Need of Urgent Safeguarding” by UNESCO in 2017. The end goal of this research project is a collaborative book on cantos de arreo y ordeño, as adapted for an English-speaking audience. It is through the culmination of this paper that the following political processes are explored: the dissection of the history of industrialization in Columbia and Venezuela, statistics on the industrial agricultural sector, and specific government policies that discouraged or continue to discourage the development of human-animal relationships; through this exploration I hope to find the role of the governments of Colombia and Venezuela in contributing to the decline in rural farming with the inverse growth of factory farming, in order to bridge the divide between industrialization and interspecies relationships.

Karen Tovar
UROC-H

Llano work songs: The Outcome of Mestizaje in Regards to Llaneros in Colombia and Venezuela

By: Karen Tovar, Bristin Scalzo Jones, PhD

Colombian-Venezuelan llano work songs were declared as Intangible Cultural Heritage since 2017 by UNESCO in Need of Urgent Safeguarding. Llano work songs consist of tunes on the themes of collective stories of llaneros. It's a practice of cultural importance in regards to the llanero national identity but today these work songs are unfortunately diminishing. Hardly any scholarly research has focused on the cultural construction of the llaneros. Ethnically, llaneros have a multicultural ethnic makeup from Europeans, Indigenous people, and Africans. This research interprets how the llanero culture was made through colonization and what influenced the most important aspects within their culture including music, horsemanship, and the role of women in the llanos. By introducing my audience to the context of the llanero culture regarding colonization, I argue that the llanero culture is a cross cultural exchange resulting in mestizaje, and is marginalized because of their cultural hybridity. I counteract the belief that they are “uncivilized” by analyzing the llano work songs. The purpose of this research is too shed a light on the importance of the llanero culture, and why their culture is unfortunately repressed as a way to put forward their diminishing cultural practices.

Kayle Fox
UROC-H

Central Valley Child Labor

By: Dr. Stephanie Canizales Kayle Fox

Reports of child migrant labor across the U.S. have increased in the last decade, especially in industries like agriculture, construction, and manufacturing. The Central Valley is home to 25% of agriculture in the U.S. The workforce is estimated to be about 92% immigrant, and 77% undocumented. Children are among the undocumented migrant workers. This research examines Central American and Mexican migrant children working in the California Central Valley’s agriculture industry to ask why they are engaged in such work, what the conditions of their everyday work are, and how their work shapes non-work. To answer these questions, we will conduct interviews with service providers across five agencies working with child migrant workers in the Central Valley. This research aims to: (1) understand the challenges child migrant workers face, (2) the resources, like housing and financial assistance, healthcare, and family support, that might be available to them, and (3) the challenges that service providers encounter as they attempt to serve undocumented child workers.

Maria G. Reza
UROC-H

Empowering non-native English speaking students: Nurturing self-efficacy for writing
By: Maria G. Reza, Lindsay K. Crawford, PhD

The current study explores the effects of an upper-level undergraduate writing-intensive Health Communication course on self-efficacy for writing. The purpose of this study was to identify strategies for improving self-efficacy for writing, particularly among underrepresented groups, as the study population was majority female, Hispanic, non-native English speakers, and first-generation college students. Student's self-efficacy for writing was measured using the Self-Efficacy for Writing Scale (SEWS) which was administered twice; once at the beginning of the semester and once at the end. Results showed statistically significant differences in students' pre- and post-self-regulation and writing convention scores (15% and 10% increase, respectively). These scores suggest major improvement in students' self-reported abilities for writing mechanics and the regulation of their writing process. Subsequently, two focus groups were conducted to gain insight into how students' self-efficacy for writing was affected by the class content, assignments, instructor feedback, and classroom environment. Findings suggest that students valued small class sizes as well as the activities administered by the professor and the teaching assistant whom they identified as their role models for writing. Implications of low self-efficacy on writing performance and strategies for enhancing self-efficacy for writing are discussed and should be considered for implementation by educators.

Niove Aragon
UROC-H

Interventions to Prevent Childhood Obesity Among Hispanic/Latino Children: A Systematic Review and Meta-Analysis
By: Niove Aragon, Kimberly Sanchez, Ph.D.

The prevalence of obesity is high among Latino/Hispanic children ages 3-12 years, living in the United States and Mexico. Many interventions have been conducted to prevent childhood obesity. The purpose of this study is to characterize intervention strategies that are the most successful at improving dietary behaviors among Latino/Hispanic children. A systematic and meta-analysis of peer-reviewed articles published until 2022 were reviewed. Articles were included in they were nutrition interventions focused on improving dietary behaviors among Hispanic/Latino children 3-12 years living in either the U.S. or Mexico border states. The randomized-effect model will be used to determine the pooled effects. Meta-regression analysis will be conducted to examine the association between dietary behaviors (i.e., fruits, vegetables, sweetened-sugar beverages) and the type of intervention strategies such as the study design (randomized controlled trial, quasi-experimental, or pre-post design), intervention length, setting (e.g., school, home, community center), and level of focus (personal, family, community, or policy). A total of 47 studies will be included in the analysis. Interventions mostly focused on individual level (n=31), were family-based (n=29), the community (n=15), or were multi-level (n=5). Identifying intervention strategies that improve dietary behaviors holds the potential to prevent childhood obesity.

USDA

The mission of the USDA program is to increase the numbers and diversity of students successfully continuing their research careers by pursing graduate education. A part of this program will allow students to attend a national conference, such as the Society for the Advancement of Chicanos and Native Americans in Science (SACNAS) to present their research findings. SACNAS is a large, multi-disciplinary conference targeting primarily UG that is annually sponsored by the USDA. Attending a national conference is especially important to the scholar's experiential learning process as it provides opportunities to participate in numerous professional/career skills development workshops and to network with peers and potential colleagues to advance educational and professional opportunities. Supported by United State Department of Agriculture Hispanic-Serving Institutions funding, the Center for Information Technology in the Interest of Society, the Wonderful Company, Almond Board of California, our affiliated partners and the esteemed faculty of UC Merced, we expand research training opportunities to our diverse population of students.

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Daisy R. Zapet Bamac
USDA

Effects of CBD on the Activation of Cardiac Protein Kinase B in a Rat Model of Metabolic Syndrome

By: Daisy R Zapet Bamac, Elia G Lopez, Jessica Wilson, Dora A Mendez, MS, Rudy M. Ortiz Ph.D.

The activation of protein kinase B (AKT) is a critical step in the post insulin receptor signal transduction. In cases of insulin resistance, glucose uptake is reduced when insulin fails to properly promote its receptor-mediated signal transduction. Insulin resistance is a component of the metabolic syndrome (MetS), which is a contributing factor of cardiovascular disease (CVD). While recent studies on the medicinal effects of cannabidiol (CBD) suggest it can ameliorate risk factors of CVD, its effects on glucose metabolism in the heart are less understood. To investigate this, the Otsuka Long Evans Tokushima Fatty (OLETF) rat, a model of MetS, and its healthy strain-control, the Long Evans Tokushima Otsuka (LETO) rat, were used. Rats were assigned to three groups (n=8/group): (1) untreated LETO, (2) untreated OLETF, and (3) OLETF + H4CBD (200mg/kg/day x 4 weeks). Because CBD has been shown to improve glucose tolerance, we expect it to increase the phosphorylation (activation) of AKT in the heart. This study will give insight into the effect of CBD during metabolic syndrome to further investigate effects on glucose metabolism.

Diane Martinez-Gomez
USDA

4A Review of Environmental Life Cycle Assessments of Alfalfa

By: Diane Martinez-Gomez, Colleen C. Naughton, PhD

Alfalfa is a major crop vital for beef, milk, and cheese production. Recently, Alfalfa has come under scrutiny for the amount of water it requires. However, flood irrigation of Alfalfa contributes to groundwater recharge and is more flexible in watering than higher value orchard crops that are replacing alfalfa fields. To better understand the impact of alfalfa on the environment, we reviewed life cycle assessment (LCA) studies of alfalfa. LCA is a methodology that quantifies the environmental impact of an agricultural product from cradle-to-farm-gate including land preparation, planting, growing, and harvesting. Quantitative data was collected through literature reviews from Web of Science and Agricola database searches. From review of 10 studies, the majority of emissions from alfalfa production come from cultivation. During cultivation, the crop must be irrigated and fertilized, which requires a high consumption of electricity and results in the highest share of environmental emissions. Even though it requires a vast amount of water, alfalfa provides the most protein for livestock and helps to store carbon in soil among other benefits. By identifying the key sources of emissions and exploring more efficient and sustainable farming practices, such as farms employing advanced irrigation procedures, we can help reduce the environmental impact of alfalfa.

Mario Paredes
USDA

Angiotensin Receptor Blockers Regulate Fatty Acid Transportation in OLETF Rats Fed a High Cholesterol Diet

By: Mario Paredes^1, Ruben Rodriguez Ph.D^1, Jacqueline N. Minas^1, Daisuke Nakano Ph.D^2, Akira Nishiyama Ph.D^2, and Rudy M. Ortiz Ph.D^1

Nonalcoholic fatty liver disease (NAFLD) is a precursor condition leading to hepatocellular carcinoma, the most common form of liver cancer. NAFLDs progression is associated with metabolic syndrome (MetS), a cluster factor of conditions, including atherogenic dyslipidemia, obesity, and hypertension. High cholesterol diets (HCD) contribute to MetS risk factors and NALFD. HCD induces an upregulation of fatty acid transportation within the liver contributing to excess hepatic triglyceride (TAG) production. Chronic treatment of angiotensin receptor blockers (ARBs) are capable of attenuating elevated lipids that are associated with MetS. The purpose of this study is to further assess the potential of ARB treatment to attenuate hepatic fatty acid uptake during MetS, despite consumption of a HCD. 5-week Otsuka Long Evans Tokushima Fatty (OLETF) rats, a model of MetS, were fed a HCD (2% + 0.5% cholic acid) for 4 weeks followed by treatment with ARB (10 mg olmesartan /kg /d) for 3 weeks by oral gavage. Rats were assigned to one of 5 groups: 1) lean-strain control Long Evans Tokushima Otsuka (LETO; n=10), 2) untreated OLETF (n=12), 3) OLETF + HCD (n=12), 4) OLETF + ARB (n=12) and 5) OLETF + HCD + ARB (n=12). We anticipate fatty acid transporter protein 2 (FATP2) and fatty acid translocase (CD36) levels to be lower in groups treated with ARB compared to the untreated groups indicating

Wolf Race

Wolf RACE (Resource Availability and Competition in Ecosystems) Examining the effects of Climate Change on Wolf Ecology - Insights from The McKittrick and Rancho La Brea Lagerstätte

This project explores how marine resources impact wolf and coyote ecology both in modern and ancient systems. One component of the project studies pre-historic and historic wolf ecology in Sweden. The UROC project this summer developed a method to screen fossil samples from ‘tar pit’ sites for suitability for stable isotope analysis and C-14 dating. This project is funded by a NSF award from Sedimentary Geology and Paleobiology (2138163) to Drs. Robin Trayler and Sora Kim.

Lauren Lopes
Wolf Race

Rapid Screening of Tar Seep Fossils for Radiocarbon and Stable Isotope Analysis
By: Lauren E. Lopes, Robin B. Trayler, PhD

Tar seeps trap and preserve diverse fossil assemblages which reflect environmental histories and ecosystem interactions. While the macro preservation of fossils is usually acceptable, preservation of organic bone collagen is unpredictable. Radiocarbon dating (14C) and stable isotope analysis (δ13C, δ15N) of tar seep taxa are further complicated by tar infiltration. Identifying collagen preservation before sampling and tar removal methods would save resources and minimize damage to collections. Visual scoring and infrared spectral analysis (FTIR) were used to identify collagen. We used samples from the Rancho La Brea and McKittrick tar seep collection housed in the University of California Museum of Paleontology with varied radiocarbon dating success. We also collected FTIR spectra for ~80 McKittrick tar seep fossils with unknown collagen preservation. We calculated indices from the quantifiable absorbance bands for organic amide, phosphate, and carbonate groups to examine collagen and tar content. Our results from the previously investigated fossils show that FTIR can differentiate tar seep collagen preservation. Approximately half of the unknown McKittrick tar seep data fell within the “well-preserved” group indicating sufficient collagen. Although collagen was found less often in more weathered fossils, visual cues alone were unreliable. This preliminary, rapid, and minimally destructive assessment can identify samples suitable for radiocarbon dating and stable isotope analyses, which can increase the success rate of these tedious and costly analyses.

Acknowledgements

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